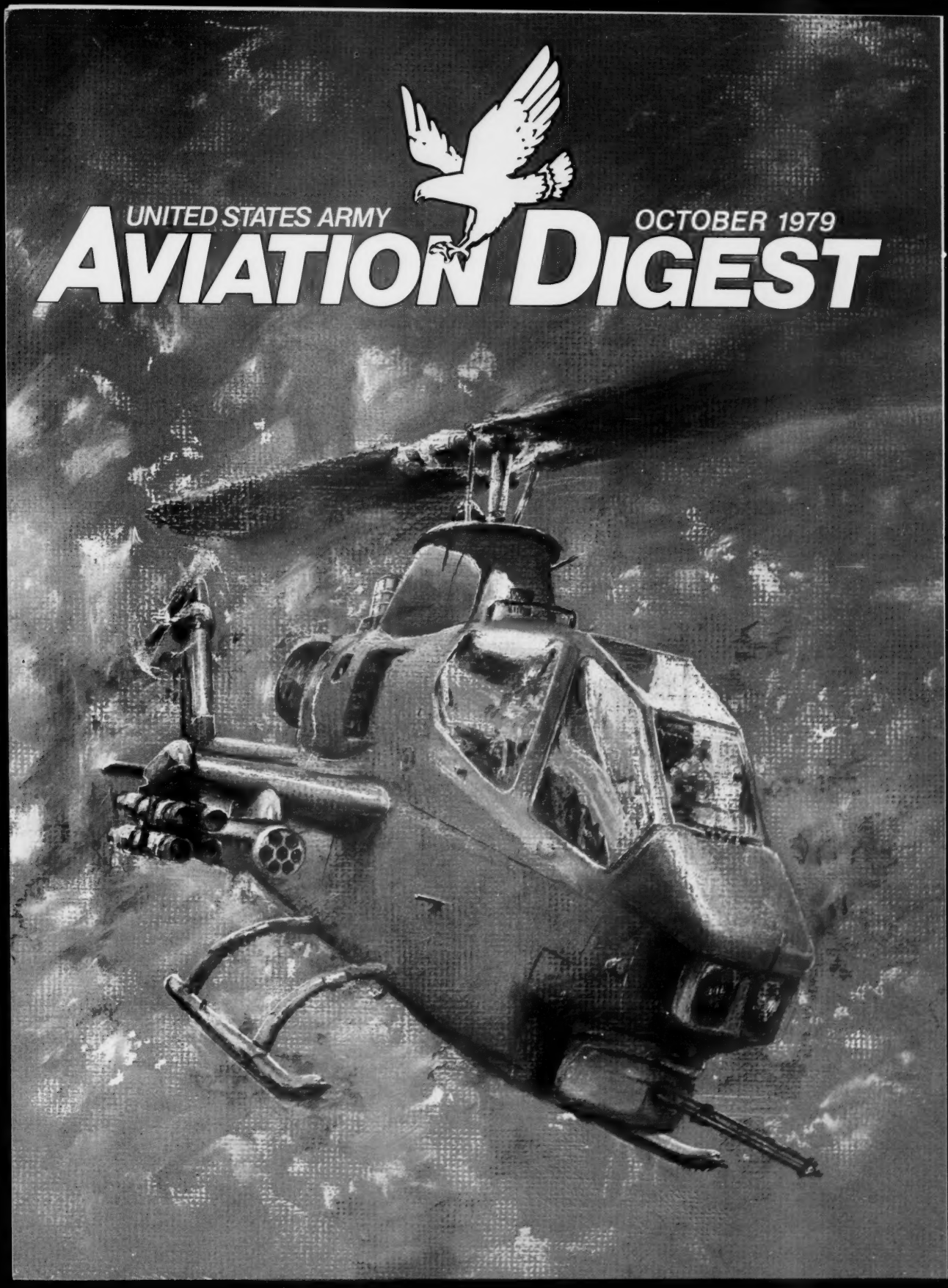
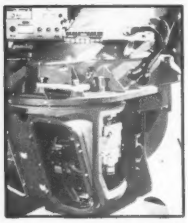

UNITED STATES ARMY
OCTOBER 1979
AVIATION DIGEST

OCTOBER 1979 • VOLUME 25 • NUMBER 10

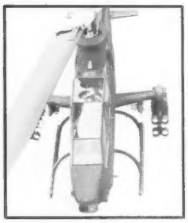
★
Brigadier General Richard D. Kenyon
Army Aviation Officer
ODCSOPS, Headquarters,
Department of the Army

★★
Major General James H. Merryman
Commander
U.S. Army Aviation Center
Fort Rucker, Alabama

★
Brigadier General Carl H. McNair
Deputy Commander
U.S. Army Aviation Center
Fort Rucker, Alabama



page 5



page 25

page 49

page 61

page 65

1 **From The Aviation Center Commander,** MG James H. Merryman
2 **Cobra Program Position Report,** COL Jay W. Pershing
5 **Modernized Cobra Fire Control System,** George L. Cohill
14 **The Threat: Air-To-Air . . . Fact Or Fiction,** CPT Carl Daschke
16 **What's New in Aviation Training Literature: SQT Help For The 93H/J,** 2LT David R. Halverson
18 **OH-58 Kiowa A, C, Aircraft Qualification Course**
19 **Views From Readers**
20 **Air Attack,** Dean Fletcher
22 **DES Report To The Field: What's In A Chart?**
23 **Eagle Save**
24 **CH-47 Deployment,** Betty Goodson
25 **Modernized Cobra,** COL Jay W. Pershing
46 **The Aircrew Training Program (Formerly Known as the Flying Hour Program),** CPT David R. Esterak
49 **Hi, I'm A Distraught Flight Simulator,** MAJ Michael F. McGaugh
54 **It Can Happen To You,** CPT George Kerrigan
56 **Copilot Error**
58 **PEARL's**
60 **OPMS Corner: Aviation Personnel Update,** MAJ William B. Leonard III
61 **JAAT,** SSG Bob Hubbert
65 **Operation Northern Leap**
68 **ATC Action Line: GCA Controller/Pilot Proficiency**
Inside Back Cover: **Helicopters And Parachutes Not Always Compatible,** LTC Larry G. Kelly
Back Cover: **Safety Conference,** Betty Goodson

Cover: **The AH-1S modernized Cobra bursts upon the scene Armywide. This issue features updated and new articles about the S model (pages 2, 5 and 25). Illustration by Fred Martin**

Richard K. Tierney
Editor

The mission of the ***U.S. Army Aviation Digest (USPS 415-350)*** is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

The ***Digest*** is an official Department of the Army periodical published monthly under the supervision of the Commanding General, U.S. Army Aviation Center. Views expressed herein are not necessarily those of the Department of the Army nor the U.S. Army Aviation Center. Photos are U.S. Army unless otherwise specified. Material may be reprinted provided credit is given to the ***Digest*** and to the author, unless otherwise indicated.

Articles, photos and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, ***U.S. Army Aviation Digest,*** P.O. Drawer P, Fort Rucker, AL 36362.

This publication has been approved by The Adjutant General, Headquarters, Department of the Army, 23 February 1979, in accordance with AR 310-1.

Active Army units receive distribution under the pinpoint distribution system as outlined in AR 310-1. Complete DA Form 12-5 and send directly to CDR, AG Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220. For any change in distribution requirements, initiate a revised DA Form 12-5.

National Guard and Army Reserve units under pinpoint distribution also should submit DA Form 12-5. Other National Guard units should submit requests through their state adjutant general.

Those not eligible for official distribution or who desire personal copies of the ***Digest*** can order the magazine from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Annual subscription rates are $17.00 domestic and $21.25 overseas.

THOSE OF US fortunate enough to have enjoyed a long association with Army aviation have witnessed many changes over the years. We have seen Army aviation grow from its pre-Vietnam support role to the proud position it occupies in today's combat ready force. We can point with pride to the ever-increasing role that Army aviation plays in counteracting threat forces throughout the free world.

Major General Merryman

Today, at least symbolically, we embark on another chapter in our proud history. The new masthead which appears on the cover of this month's issue of *Aviation Digest* is designed to represent Army aviation today. This new masthead, as symbolized by the hawk, is indicative of the fighting spirit of Army aviation units and underscores our versatility as a full-fledged member of the combined arms team. The hawk, a magnificent bird of prey that uses strength, quickness and the element of surprise to outmaneuver its opposition, is indeed a worthy addition to the masthead of the *Aviation Digest*. It symbolizes Army aviation's new role as a combat arm.

Other significant changes are occurring in the area of aviation operational concepts and commissioned officer career patterns.

Today to counter the probable threat, a requirement exists in Europe as well as in many other places around the world for highly mobile, lethal forces. Army aviation must play a major role in providing this capability. To do this Army aviation units must be organized so that we use their full potential. Currently the Army is studying the establishment of an aviation brigade in its divisions. It would provide the division with a fourth maneuver brigade headquarters. The new organization is called the Air Cavalry Attack Brigade (ACAB) and would consist of battalion sized elements consisting of attack helicopter squadrons and a combat support aviation battalion. Operating as a full-fledged member of the combined arms team, the brigade's firepower and mobility could be critical to our success on the battlefield of the future. An article on the ACAB will be forthcoming in a future issue.

To support Army aviation's expanding battlefield commitments, the Army Chief of Staff last spring announced major changes which establish a new Army aviator career pattern. Designed to create long-term management policies for developing aviators under the Officer Personnel Management System (OPMS), the changes affect branch determination, officer basic and advanced courses, initial utilization following flight school and additional specialty development.

In the July 1979 issue of the *Aviation Digest*, MAJ William B. Leonard discussed in depth the new career management program for commissioned aviators which is underway within the Military Personnel Center (MILPERCEN). This program also was detailed by LTC George A. Morgan in the April 1979 issue of the *Digest*. It is recommended that you familiarize yourself with these changes and how they may affect your aviation career. The OPMS Corner in the *Aviation Digest* has been carrying a continuing series on the emerging career management program.

This issue of *Aviation Digest* is significant in another aspect as well. It features an update on the AH-1S Cobra with a lead article by the project manager, COL Jay W. Pershing (page 2). In addition, the three-part AH-1S series which appeared in the January, February and March 1978 issues has been updated and begins on page 25. The *Aviation Digest* has received requests for thousands of reprints of these articles, and they continue to come in.

The modernized Cobra, with its improved firepower and mobility is keeping pace with the increasing emphasis being placed on the role of Army aviation as a combat arm. So is the *Aviation Digest* with its new masthead.

Major General James H. Merryman
Commanding General
U.S. Army Aviation Center and Fort Rucker
Fort Rucker, AL

MODERNIZED COBRA

Cobra Program Position Report

Colonel Jay W. Pershing
Project Manager, Cobra, TSARCOM
St. Louis, MO

THE AH-1S modernization program has continued to progress since it began in 1975. Today we are about halfway through the modernization effort and are fielding the new production Enhanced Cobra Armament System (ECAS) Cobra with the 20 mm cannon and universal turret.

The chart on page 4 provides an overview of the total modernization effort. The delivery schedules for the different AH-1S models are shown in each block. New production deliveries are shown in step 1 (production S), step 2 (up-gun S) and step 3 (fully modernized S). Modification of the existing AH-1G fleet is shown in the top block (mod S) and step 3 (AH-1G to fully modernized S).

Major modifications being added to the AH-1S in the separate steps include the tube-launched, optically-tracked, wire-guided (TOW) missile system, helmet sight subsystem, up-rated engine and powertrain, improved avionics and aircraft survivability equipment, universal turret with a 20 mm cannon, rocket management subsystem and fire control system. Details of these improvements are discussed in the three modernized Cobra articles at the center of this issue.

Completion of the three steps of the recycle program shown at the lower right of the chart will provide the Army with a standardized Cobra fleet with increased firepower and performance. Fielding of the 98 aircraft shown in step 2 of the chart has been accomplished at Ft. Hood, TX; Ft. Campbell, KY; Ft. Bliss, TX; and Ft. Bragg, NC.

Fielding of the remaining aircraft in step 2 began at Ft. Carson, CO last month. As a matter of interest, the aircraft assigned to Ft. Bliss were the first to be equipped with the new improved main rotor blade. It is planned that all future new production aircraft will have the new blades installed.

As the new production AH-1S Cobras are fielded, the remaining AH-1G fleet is being phased into the Bell Helicopter Amarillo, TX facility for modification to the fully modernized AH-1S aircraft. After next month all aircraft delivered from the new production line in Ft. Worth, TX and the modification line in Amarillo will be in the fully modernized configuration.

Operational readiness rates for the Cobra/TOW aircraft have met or exceeded the Department of the Army standard of 70 percent since its initial fielding in 1975. The overall Cobra fleet (AH-1G and AH-1S) operational readiness (OR) rate was 78 percent in February 1979. This was the highest OR rate ever achieved by the AH-1 fleet.

The contractor's testing of the fully modernized AH-1S with the new fire control subsystem was completed last June. Test results to date on the fully modernized

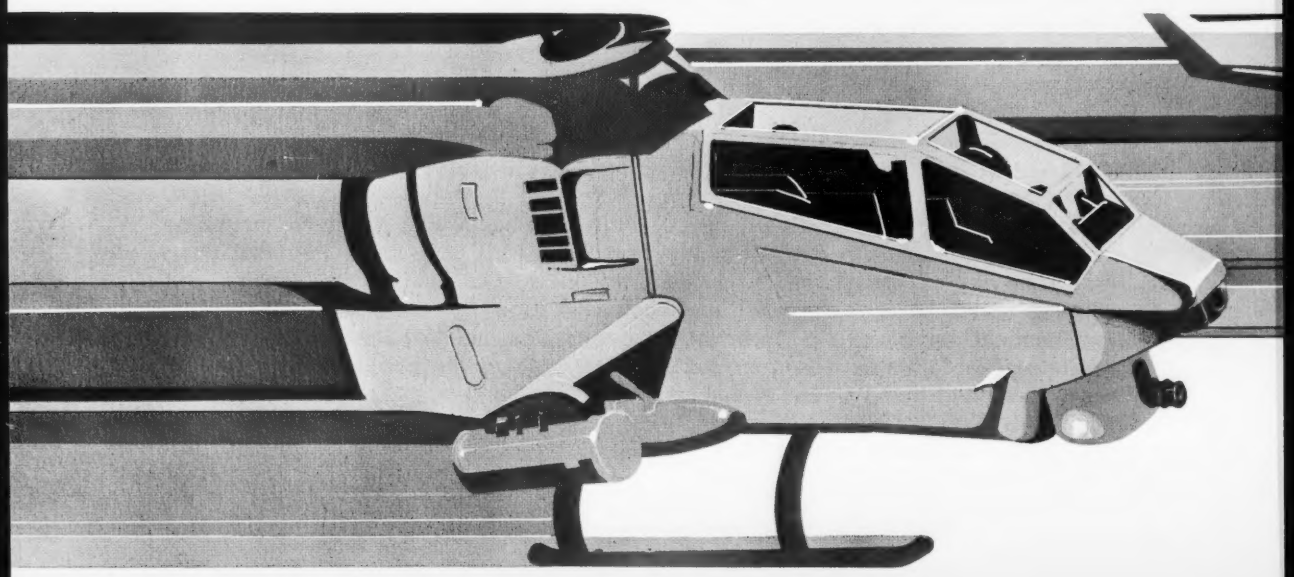
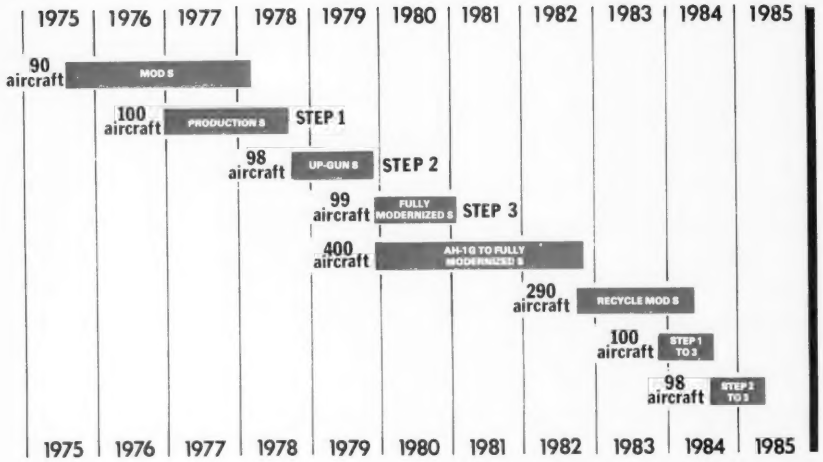


Illustration by LT David Deitrick

Cobra have been extremely encouraging, surpassing our expectations, particularly the deadly accuracy being achieved with the 20 mm cannon. Development testing (DT) began in July with operational testing (OT) scheduled to follow this month. Completion of DT/OT testing is set for next month, when it is planned for the first fully modernized AH-1S to be delivered to the Army. Monthly meetings with



AH-1S Modernization Program Schedule

U. S. Army Missile Command, U.S. Army Armament Readiness Command, U.S. Army Communications and Electronics Materiel Readiness Command, U.S. Army Troop Support and Aviation Materiel Readiness Command and Bell Helicopter are being held to assure all necessary actions are taken to obtain a timely materiel release of the fully modernized AH-1S.

When the fully modernized Cobra is first fielded the laser rangefinder and airborne laser tracker (ALT) will not be installed. The laser experienced some technical problems, which, coupled with increased production leadtime, have caused a slippage until next July. Aircraft fielded without the laser rangefinder will be retrofitted in the field by exchanging standard TOW missile subsystem telescopic sight units (TSU) with laser rangefinder equipped TSU. The decision to defer installation of the ALT is related to the availability of a fielded laser designator. Each aircraft will be equipped with complete provisions so the ALT can be installed in the field at the appropriate time.

Future AH-1 Configurations. Last August a memorandum of understanding (MOU) on AH-1 configuration was established among the commanding generals of the Aviation Center, Armor Center and TSARCOM. The MOU establishes the AH-1S configuration and assures that future changes to the AH-1 will enhance the combat effectiveness of the Cobra weapon system. All three principals must agree to any future configuration changes. As a result of the agreement, action has been initiated to terminate the CONUS navigation package, proximity warning receiver and the M-130 chaff dispenser.

The 1978 Army Aviation Systems Program Review highlighted some operational limitations of attack helicopters for the future battlefield. For the Cobra, the lack of a night capability is an operational limitation. In an effort to provide a limited night capability, the Cobra project manager in conjunction with Night Vision Laboratories has initiated a feasibility demonstration program for a FLIR (forward looking infrared radar) Augmented Cobra TOW Sight (FACTS). The FACTS system will provide the copilot gunner with an improved capability to acquire and engage targets during periods of poor daylight visibility (dawn, dusk, smoke, haze, etc.) and at night.

The feasibility demonstration program is ongoing with the objective to demonstrate the improved AH-1S adverse weather target acquisition capabilities and to form a basis for a required operational capability change in support of a development program for FACTS. Contractor tests conducted in August were completely successful. Five TOW missiles were fired and all missiles hit the target.

The Cobra TOW program is a vital one for the defense of our country. The Cobra team is working hard to provide the best attack helicopter weapon system for our fighting force now!

COL Pershing entered the Army in 1954 after being graduated from Purdue University in West Lafayette, IN. He earned a master's degree in Business Administration from Michigan State University, East Lansing, and is a graduate of the Army War College

Figure 1

Modernized Cobra Fire Control System

George L. Cohill

Manager, Systems Integration
Bell Helicopter Textron
Ft. Worth, TX

THE MODERNIZED AH-1S Cobra is the result of a series of evolutionary changes responding to a changing battlefield environment. When the AH-1G was introduced to combat in 1967 the target array primarily was trucks, troops and sampans. The AH-1G's rockets and turreted 7.62 mm miniguns could be used at close ranges and at altitudes of 1,000 to 2,000 feet with good effect and relative immunity from the unsophisticated air defense capabilities of the enemy. A simple airspeed based jump correction and eyeball estimated range correction were sufficient for getting turreted gunfire near the short range targets and the fire was then walked onto the target.

For rocket delivery a manually preset combining sight was used along with the tactic of making a shallow dive at the target. These "canned maneuvers" were practiced until some of the old hands became proficient at delivering rockets under a particular set of conditions.

The battlefield of today, dominated by armor accompanied by sophisticated air defense capabilities, requires a gunship able to deliver accurate fire on the first burst at standoff ranges while flying nap-of-the-earth. The modernized Cobra with its TOW missile system, 20 mm turreted gun, remote set fuzing multifunction rocket warheads, rocket management system, and integrated gun and rocket fire control system (figure 1) is equipped to respond to the demands of this new, more sophisticated battlefield environment. The addition of the TOW missile system (figure 2) to the AH-1G in 1972 gave the capability to

deal with the armor threat of the modern battlefield.

In the spring of 1978 the universal turret subsystem with its 20 mm automatic cannon was qualified on the AH-1S (see page 34, figure 3, this issue). As part of the same program the addition of the rocket management subsystem (page 38, figure 7) gives the AH-1S pilot the capability to manage the inventory of as many as 76 rockets of five different types, to select and fire them at various rates and to remotely set the RC fuzing system in the rockets.

The stabilized telescopic sight unit from the TOW missile system can be used to aim the turreted 20 mm gun. The AH-1S, therefore, had all of the elements for aiming and firing the 20 mm cannon at standoff ranges, but did not have a fire control system to provide the necessary lead angle and super elevation corrections to make the gunfire system adequately accurate at those ranges. The same was true of the rocket system. The manual techniques used in Vietnam were totally inadequate to handle the problem of firing rockets from nap-of-the-earth, at hover and low air speeds, and out to ranges of 6,000 meters with sufficient accuracy to make the weapon effective.

Studies conducted at Bell Helicopter Textron and tests conducted by the Army had shown that gunfire and rocket fire accuracy could be improved by factors of two to five by the addition of a full solution fire control system. During the fall of 1976 BHT performed detailed systems studies and prepared a set of specifications for a laser rangefinder, an omnidirectional air data system, a head-up display and a digital fire control computer. In the spring of 1977 Bell conducted a competition and source selection for the four major elements of the fire control subsystem. These major subsystems were integrated by BHT with the TOW missile system, the XM-128 helmet sight subsystem, the AN/ASN-128 light-weight doppler navigation subsystem, the airborne laser tracker, the rocket management subsystem, the universal turret subsystem, and several other onboard subsystems to provide a full solution fire control subsystem for the AH-1S. A functional block diagram of the fire control subsystem is shown in figure 3.

In the subsequent paragraphs the fire control system is described in terms of a few of its primary modes of operation. Highest accuracy gunfire is achieved using the TSU for target acquisition and tracking. In this mode the gunner tracks the target with the TSU and obtains accurate laser range to the target by means of the TSU mounted laser rangefinder. The universal gun turret is connected to the TSU through the interface control unit. In the absence of gunline commands from the fire control computer, the gun turret points at the same target that the TSU is tracking. The fire

Glossary

AADS	airspeed and direction sensor
ADS	air data subsystem
BHT	Bell Helicopter Textron
CRT	cathode ray tube
DC	direct current
EPU	electronics processor unit
FCC	fire control computer
FLIR	forward looking infrared
HUD	head-up display
HUDS	head-up display system
H_2	hertz
LAAT	laser augmented airborne TOW
LAI	low airspeed indicator
LOS	line-of-sight
mm	millimeter
mrad	milliradians
MTBF	mean time between failure
RC	recent capacitance
RMS	rocket management system
TOW	tube-launched, optically-tracked, wire-guided
TSU	telescopic sight unit
TTL-MSI	transient transient logic—medium scale integration
V	volt
VA	voltampere
W	watt

Figure 2

TOW Missile System Components

control computer takes in line-of-sight angles, line-of-sight angle rates and range data from the TSU; air data (three dimensional airspeed, static pressure and air temperature) from the air data set; three dimensional aircraft ground speed from the doppler; and aircraft pitch and roll angles with respect to the local vertical from the vertical gyro.

With the range and LOS rate data and doppler velocity data, the computer generates an estimate of target ground velocity and aircraft ground speed. Wind speed is computed by combining doppler velocities and vector airspeed from the air data set. Air density is computed from the static pressure and temperature data.

All of the preceding parameters are combined by the computer in a set of ballistic equations to compute azimuth and elevation offset angles by which the gun turret must be displaced from the line-of-sight to the target in order for the bullets to hit the target. Boresight corrections which are stored in the fire control computer are added automatically to the azimuth and elevation offsets to account for boresight errors.

The final azimuth and elevation offset angles are updated at a 50 Hz rate and added to gun lines displacing the gun turret from the TSU line-of-sight by a corresponding amount. When the gunner pulls the trigger the cannon fires a burst of 20 mm rounds at a 730-shot per minute rate. The projectiles should intercept the target at the point where the target will be when the projectiles arrive. In the fire control solution the computer has accounted for range, projectile ballistics, aircraft to target geometry, aircraft attitude, aircraft motion, angles of attack and sideslip, wind, air density, target motion and weapon system boresight error.

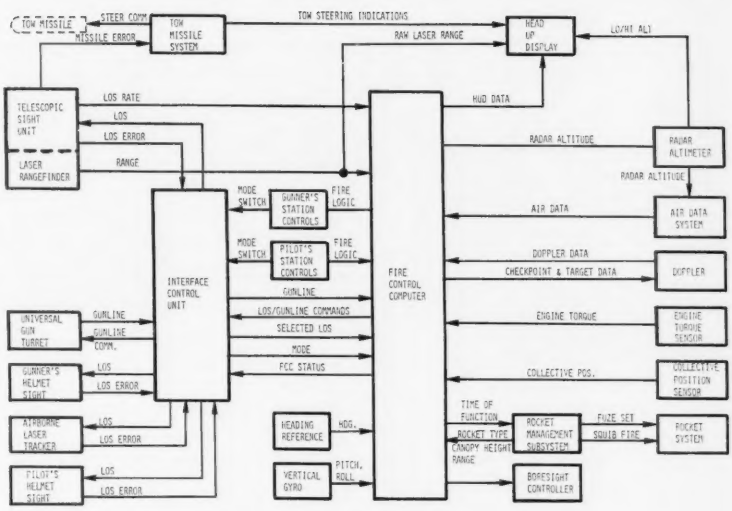


Figure 3

Modernized Cobra Fire Control Subsystem

Either crewmember can use the helmet mounted sight to direct gunfire. In this mode accurate LOS angle rate information is not available and manually estimated range is used, but the fire control solution accounts for all of the other variables listed above. The helmet mounted sight directed gunfire mode is not as accurate as the TSU directed mode, but since the helmet sights are used for snap shooting at close-in targets, high accuracy is not required.

There are two basic modes of rocket delivery, direct and indirect. In both modes the pilot uses the head-up display as the primary sighting system. In the direct mode the fire control computer takes in range information from either the laser rangefinder or manually set range on the rocket management panel; the type of rocket selected by the pilot on the RMS panel; and collective position for downwash computation; in addition to the inputs (other than LOS and LOS rate) used for gunfire.

The fire control computer calculates a solution to the rocket delivery problem and positions the HUD fire control reticle in azimuth and elevation. The pilot then maneuvers the aircraft in a way such that the reticle superimposes on the target and punches off the rockets. Based upon the rocket and penetration mode selected by the pilot the computer also computes a time of function or a penetration delay for the fuze.

The indirect rocket delivery mode uses the TSU as the target acquisition and tracking sensor. The HUD is used as if it were an ordinary cathode ray tube type display as opposed to a see-through combining sight. Under certain conditions such as long ranges (more than 4,800 meters) it is necessary to elevate the nose of the Cobra so much that it actually interferes with the pilot's line-of-sight to the target.

Figure 4
Head-Up Display Subsystem

Under these conditions the pilot cannot superimpose the fire control reticle on the target which must be done in the direct mode. The pilot, therefore, switches to the indirect mode and has the gunner track and range on the target. The LOS and range data from the TSU is combined by the computer with the other parameters described above and the fire control reticle is displaced by the appropriate amount. Pilots then fly the aircraft in a way such that the fire control reticle is superimposed on the aircraft boresight reference symbol. When the two symbols are superimposed the pilot fires the rockets which should strike the target which cannot be seen from the cockpit. The indirect mode can be used at shorter ranges as well, if the crew prefers it to the direct mode.

As stated, four major subsystems were added to the AH-1S to provide an accurate full solution gun and rocket fire control system. Each of these subsystems is described in more detail below.

The **head-up display subsystem** presents pilots the collimated symbology they require to align the aircraft for TOW missile delivery, to aim the aircraft for rocket firing, and to monitor certain critical flight parameters without diverting attention from the target scene. The HUDS (figure 4) consists of three line replaceable units, a pilot's display unit called a HUD, a symbol processor unit, and a boresightable mount.

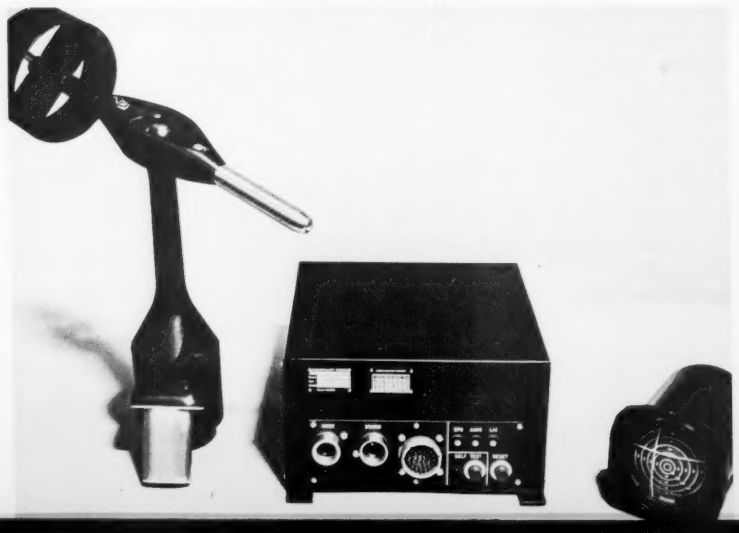
The HUD is mounted on top of the pilot's instrument panel and presents flight, target acquisition and weapon delivery information using a CRT/optical display. An optically-coated glass, dual combiner is used to reflect the symbology which is generated by the CRT into the central 20 degrees of the pilot's forward field of vision. The symbology which appears in the pilot's field of view is focused at infinity giving pilots essential information that they can view simultaneously with the target, without constantly refocusing their eyes and scanning a multitude of panel instruments during target attack. Weapons systems, fire control, flight status and flight control information are displayed, including target acquisition reticles, aircraft boresight reference, and gunner's sighting cues. The fire control data displayed includes aiming and firing data for rockets and TOW missiles and is based upon the weapon type selected by the crew. Also displayed are engine torque, radar altitude, magnetic heading and target range data information.

The symbol processor receives and processes inputs from the fire control computer and other aircraft sensors and generates all of the symbology which is displayed on the HUD.

The boresightable mount, which becomes a permanent part of the ship after boresighting, permits complete interchangeability of the HUD at the unit maintenance level without the need for reboresighting.

The head-up display subsystem is a compact, lightweight

Figure 5
Air Data Subsystem



system weighing 26 pounds. The HUDS is constructed of modules for quick replacement when maintenance is required. The current estimated MTBF is nearly 1,500 hours.

Brightness of the display can be adjusted to be compatible with night vision goggles for nighttime use. The addition of the head-up display subsystem to the modernized Cobra, with its ability to represent instant weapon delivery and flight information, significantly enhances the 24-hour mission effectiveness of the Cobra weapon system.

Accurate air data is essential for both gun and rocket fire control. This information is provided to the fire control system by the **air data subsystem.** The ADS is shown in figure 5. The air data subsystem consists of three line replaceable units: The airspeed and direction sensor (AADS), the electronics processor unit (EPU) and the low airspeed indicator (LAI). Each line replaceable unit is replaceable without any adjustment to other subsystem units.

The airspeed and direction sensor is a swivelling pitot-static probe, which senses local airflow pitot and static pressures, the angles of that airflow relative to the helicopter, and the free stream air temperature. Pneumatic pressure outputs and electronic signals for angles and temperature are fed to the EPU.

The EPU converts pneumatic pressure information to analog signals through electrical force balance pressure transducers. These pressure signals are combined with angle and temperature data by a microprocessor based computing unit. Output signals from the EPU are in the form of analog and digital formats that interface with the fire control computer (FCC), the radar altimeter and the LAI.

The low airspeed indicator is a standard 3-inch indicator which displays forward and lateral components of airspeed up to 50 knots in any direction. Digital signals are available to the FCC for forward velocities up to 223 knots.

Total subsystem power consumption is less than 25W from the aircraft 28V DC supply, and less than 200 VA from the aircraft 115V 400 Hz supply for AADS anti-icing. The subsystem weighs less than 10.5 pounds.

The single most important fire control parameter that was not available on the basic AH-1S was accurate target range data. This is especially true at the longer effective range of the 20 mm cannon. Accurate range data also is required to permit the full use of the standoff range capability of the TOW missile system. In the modernized AH-1S accurate range information is provided by a neodymium **laser rangefinder** which is integrated into the telescopic sight unit of the airborne TOW system (figure 6). This modified system is known as the laser augmented airborne TOW system. An engineering drawing giving details and identification of parts may be seen

Figure 6
Laser Augmented Airborne TOW

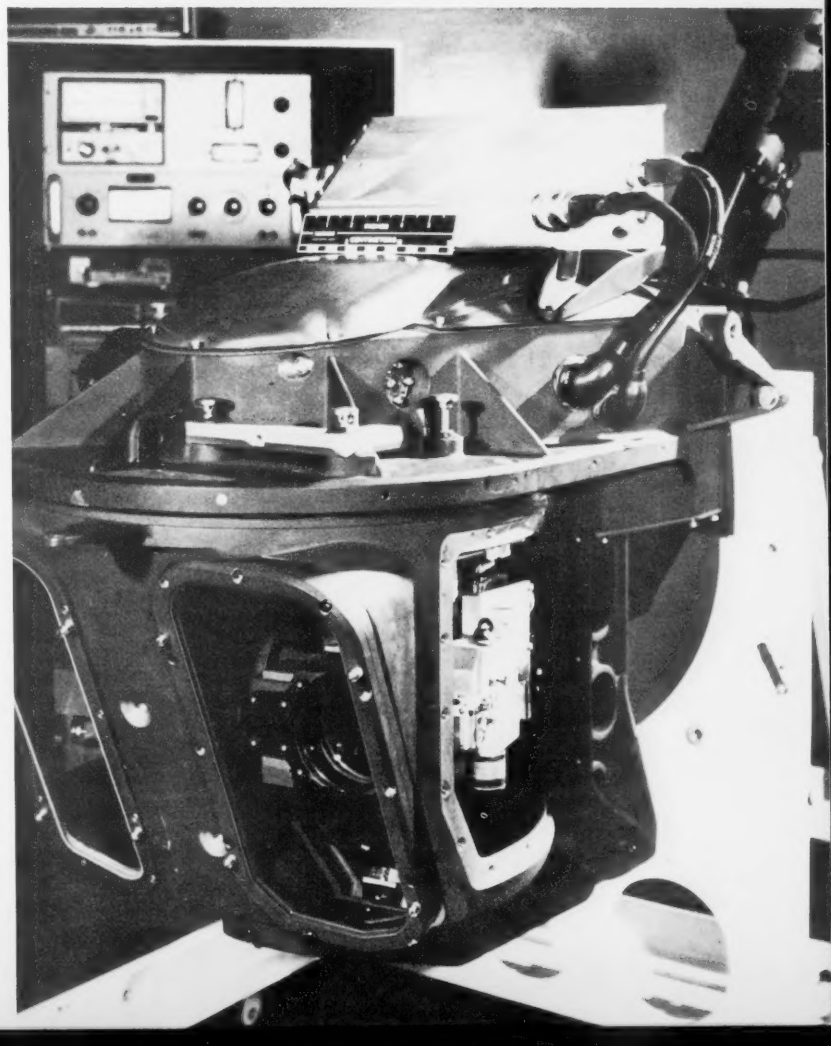


Figure 7

Characteristics of Laser Rangefinder Subsystem

TRANSMITTER	
Laser medium	Neodymium YAG
Switching	dye Q
Wavelength	1.06 μm
Beam divergence	80% in 0.5 mrad
RECEIVER	
Detector type	silicon avalanche
Max range	9900 meters
Instantaneous FOV	2 mrad $\pm$10%

on page 42, figure 6, this issue.

The laser provides four digit range values through the TSU eyepiece to the gunner and digitized serial data ranges to both the head-up display and fire control computer in less than a quarter of a second after laser trigger closure. The laser is capable of ranging to 9,900 meters. Multiple targets can be discriminated, and the gunner is provided with multiple target indication.

As shown in figure 6 the system hardware consists of a transmitter, receiver and display mounted within the sight and an electronics box mounted on top of the TSU. Complete integration is accomplished at a weight penalty of 18 pounds and a power dissipation of less than 200 watts.

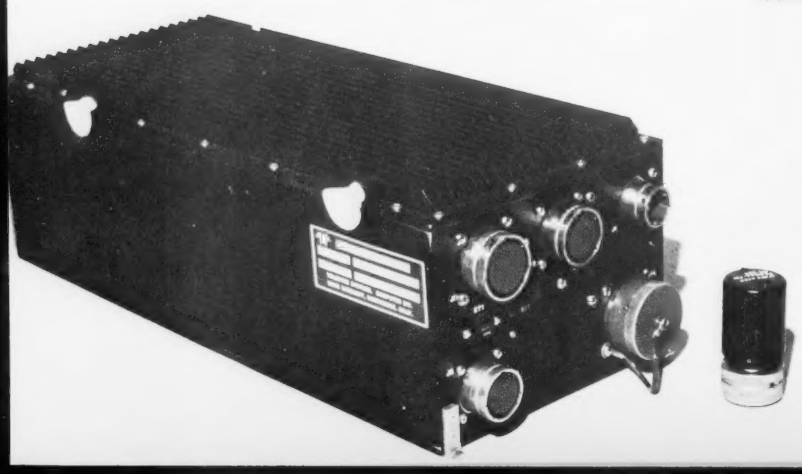
Some of the more important characteristics of the laser rangefinder subsystem are listed in figure 7.

Another feature which was included was a capability to establish a minimum range gate. The gunner can adjust this gate and exclude laser returns nearer than the gate value, such as trees in front of a target.

The modernized Cobra fire control system is tied together by the digital **fire control computer**. The FCC is shown in figure 8. The small cylinder shown in front of the unit is the boresight memory module which permits boresight data to be transferred from the FCC in the Cobra to a replacement FCC if the computer fails. Thus it is not necessary to reboresight the system when the computer is replaced.

Figure 8

Fire Control Computer



The modernized Cobra fire control computer is a 16 bit, parallel general purpose digital computer. It has evolved from the Teledyne TDY-43 family of aerospace minicomputers. The computer is mature equipment using TTL-MSI components as the primary technology base. The FCC interfaces with all of the weapon, sighting and sensor subsystems on the helicopter to provide multimode fire control solutions. The crew makes mode and weapon selections through the cockpit controls and the FCC provides coordination between sights, sights and sensors, and sights and weapons.

The multifunction operation of the FCC includes the following:

- Solves ballistic equations for eight types of 2.75 rocket and 20 mm rounds providing rocket launch line and gun prediction angle based on instantaneous atmospheric, range and target-helicopter velocity conditions.
- Performs control and switching for the various system modes of operation and establishes priorities.
- Generates drive signals for head-up display symbology.
- Performs self test, interface test and provides fault indications.
- Performs required computations to support the fire control solutions.
- Stores boresight transformation matrices for electronic boresight corrections between weapons, sights and sensors.

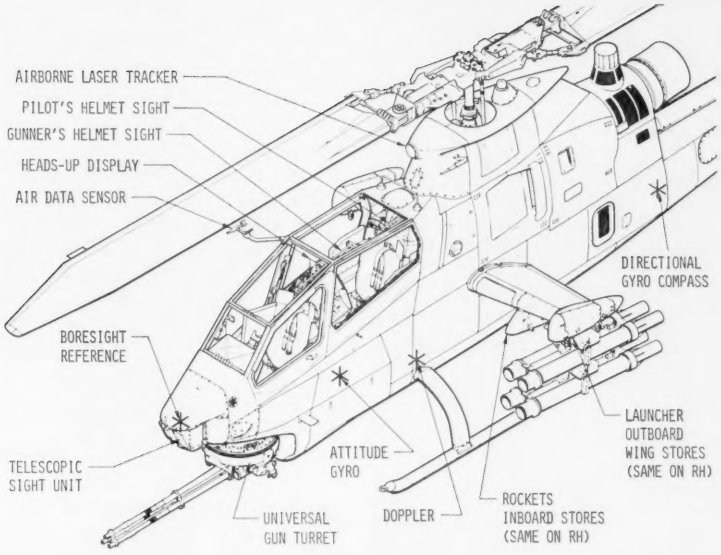


Figure 9

Components Requiring Boresighting

The FCC provides ballistic solutions at a rate of 50 times per second.

The FCC is capable of 420,000 operations per second using a standard mix of instructions and has a memory capacity of 8,192 words installed and 8,192 words additional growth capability on the same memory card. Using spare card spaces for additional memory the growth capability is 49,152 words. The present operational program occupies 7,900 words of memory leaving more than 100 percent growth capability without adding cards, and the 50 Hz fire control solution rate consumes .60 seconds per second of operating time leaving time for 66.7 percent growth in the operational program.

The modernized Cobra gun and rocket subsystem is capable of delivering highly accurate long range gun and rocket fire. For this capability to be realized, however, the elements of the armament and fire control system must be precisely aligned with each other. The process of bringing all of the elements of the system into alignment is referred to as boresighting. In figure 9 the components requiring boresighting are identified. The orientation of each of these components must be mechanically aligned and/or electronically compensated with respect to the aircraft reference (on top of the TOW telescopic sight unit) to accuracies ranging from 0.25 degree down to 0.015 degree.

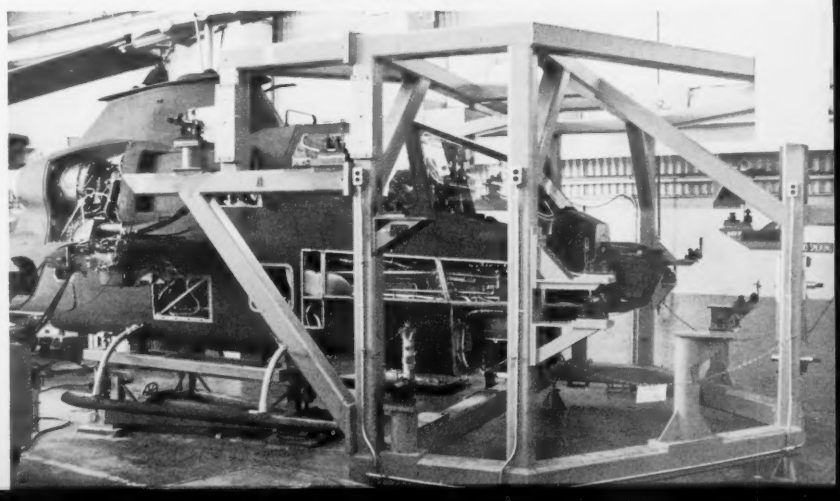
This kind of precision is accomplished in the factory during assembly of the AH-1S by means of highly accurate assembly jigs and a large, rigid boresight fixture with high precision optical telescopes and collimators. The factory boresight fixture is shown in figure 10.

It is easy to see that a boresight fixture as large and heavy as the factory fixture is not practical for application in the field. BHT, therefore, undertook the design of a boresight fixture capable of providing the required alignment accuracies but more suitable to field use. A prototype field portable boresight fixture is shown mounted on the nose of an AH-1S in figure 11. This unit provides the same basic functions as the factory boresight fixture. The boresight fixture is used with standard Army elbow borescopes and a new unit called the boresight controller (figure 12).

The boresight controller is electrically connected to the fire control computer, and permits the aircraft armament repairman to use the fire control computer to assist in boresighting the system. This is one of the major features of the new fire control system for the AH-1S. The fire control computer automatically compensates for boresight errors

Figure 10

Factory Boresight Fixture



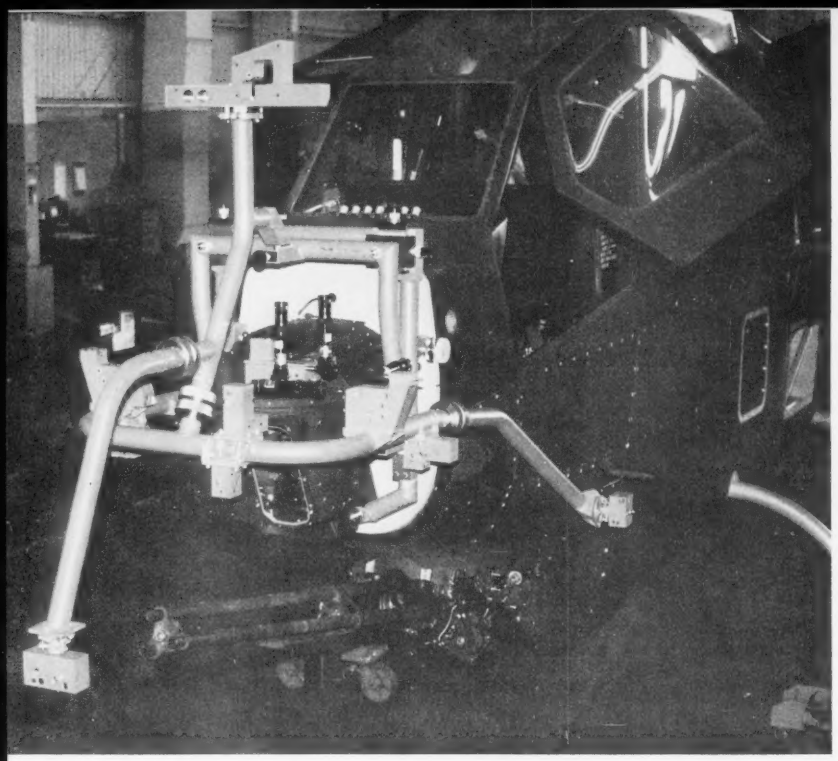


Figure 11
Prototype Field Boresight Fixture

among the armament and fire control components by storing these errors during boresighting and then incorporating boresight corrections dynamically into the fire control solution during actual firing of the weapon.

The boresight concept for the modernized Cobra armament and fire control system has been developed with careful consideration given to the problems of maintaining and replacing components in the field. If it is necessary to replace the telescopic sight unit, the system must be reboresighted. The head-up display unit, the air data sensor and the fire control computer can be replaced without reboresighting. The boresight correction data that is stored in the fire control computer is contained in a small module on the front panel of the computer. This module is removed by unscrewing a finger tight connector, pulling out the boresight memory module, and transferring it to the replacement computer.

Figure 12
Boresight Controller

The modernized Cobra boresight kit provides a number of advantages over the approach used on the AH-1Q. Despite the much tighter accuracy requirements and the new components requiring boresighting, the new system can be boresighted in considerably less time than before. This is due primarily to the fact that in boresighting the AH-1Q it was necessary to jack up and level the aircraft and set out targets over a large clear level area, and all of the final alignments were done by means of adjustment of resolvers or mechanical means. In the modernized Cobra it is not necessary to jack up or level the aircraft; day or night, indoors or out, any space large enough to hold the aircraft will do; no targets are required; and, finally, most of the high accuracy adjustments are eliminated because the fire control computer stores these small differences and accounts for them in the fire control solutions.

The elements of the modernized Cobra fire control subsystem were brought together for the first time in the Systems Integration Laboratory at the Bell Helicopter facility in Hurst, TX. Figure 13 shows the Cobra forward fuselage section that was used extensively in the integration testing. Each of the system components was installed in the location where it would go in the operational

aircraft and cable runs were made identical to those used in the aircraft. As each unit was delivered, it was functionally checked, interfaces were verified and then the units were installed and interconnected.

Then began the time-consuming task of validating and debugging the computer operational flight program and the functional interaction of the various parts of the fire control subsystem. Many interface incompatibilities, digital data channel problems and software bugs were discovered and corrected in the Systems Integration Laboratory. By the use of the integration lab it was possible to have the fire control system debugged and operating by the time the first prototype Cobra was ready. In August 1978, 13 months from the start of the development contract, the first modernized Cobra fire control system was delivered to Yuma Proving Ground, AZ for the critical issues demonstration test firing program.

In the critical issues testing at Yuma the fire control system performed exceptionally well. The 20 mm gunfire specification calls for azimuth and elevation errors less than 10 milliradians RMS required (6 milliradians RMS desired) over a spectrum of flight, range, wind and target motion conditions. Rocket test results while not as spectacular as the gunfire results show marked improvement over the results obtained without fire control. Army development testing and operational testing which are under way at the present time should provide additional data to further refine the test results.

Bell Helicopter Textron's modernized AH-1S is the free world's first production attack helicopter with a completely integrated full fire control capability. All the new components contribute to impressive weapons accuracies never before achieved in a production helicopter. The AH-1S will continue to be the front line antiarmor aircraft for 20 or more years. To capitalize on the effective fire control system, a night capability can be added. The first phase of examining this improvement was completed in August 1979 when a FLIR TOW night sight was used to guide missiles to target impact during a pitch black night. Other improvements are under consideration. The modern fire control is one important step in keeping the AH-1S up to date.

Figure 13

Systems Integration Laboratory Cobra Forward Fuselage Section

---

Mr. George L. Cohill

Air-To-Air . . . Fact Or Fiction

. . . the Soviets . . . can be expected to use this form of offensive action when presented with lucrative targets

Captain Carl Daschke
Threat Branch
Directorate of Combat Developments
Fort Rucker, AL

THE CONCEPT OF a helicopter versus helicopter threat has been discussed in tactical aviation circles for the past 10 years. Initially, there appeared to be a great disbelief concerning the subject. This skeptical attitude slowly has evolved to one of concern and interest.

The question most often asked concerning air-to-air regards capability and probability of engagement. The answer to both questions, although complex and qualified with many "if's" and "maybe's," is a resounding affirmative. The fact is that the Soviets have fielded tactical systems capable of air-to-air employment, are most probably considering the air-to-air potential of the systems, and can be expected to use this form of offensive action when presented with lucrative targets. Let's examine each of these factors more closely.

• **Equipment**—The Soviets are fielding an ever-increasing number of Hind and Hip series helicopters. These aircraft are armed (or are capable of being armed) with a lethal and versatile weapons package capable of supporting an air-to-air role. Both the Hind and Hip can mount weapons ranging from machine and gatling guns, aerial rockets and the most sophisticated antitank guided missiles, to multi- and general-purpose bombs.

The Hind A and newer Hind D represent a major advance in Soviet rotary wing technology. The aircraft has been designed to survive

in a hostile tactical environment and equipped with additional fuselage arms, internal fire extinguishing systems and twin engines to increase the survivability.

• **Tactics**—Soviet military planners have observed the evolution of U. S. Army tactical aviation from Vietnam to our present systems and employment tactics. They have drawn from our successful experiences to expand their helicopter fleet. The fact that they realize the awesome potential which our AH-1 Cobras represent is exemplified in an article in the February 1979 edition of the *Voyennyy Vestnik* (Military Herald). The article specifically includes the Cobra when it states that, "As reported . . . today already more than 50 percent of the destructive firepower potential in the tactical zone belongs to aviation. Operations from the air have ceased being auxiliary and have been transformed into a component, organic part of combined arms combat."

Since the Soviets have publicly recognized the lethal potential of Army aviation, they can logically be expected to develop techniques to counter the threat posed by our aircraft.

Although it is doubtful that Soviet planners will assign Hind and/or Hip series aircraft to the *dedicated* mission of engaging in air-to-air combat, we can certainly expect them to exploit chance meetings with our aircraft. This is especially true of our aeroscouts and antitank aircraft which possess the ability to severely hamper their armor operations.

• **Engagement**—The question which must come to mind now is: "What can I do to defeat this new threat?" Obviously, it is not an easy question to answer. There are several assumptions which must be understood in order to successfully combat the Soviet air-to-air threat.

First, where are you most likely to encounter the threat? Soviet tactics can be expected to closely mirror our own tactical employment. Aircraft operating within the tactical realm (close forward edge of the battle area operations) can expect the Soviets to also be operating in the nap-of-the-earth flight modes. Therefore, slow airspeeds and semistationary postures (holding areas) will be the rule.

Caution!

Hinds operate in pairs for mutual security and redundant weapon employment; if you encounter one, another is likely to be in the immediate area.

Like any other, the Soviet helicopter is susceptible to indirect and close air support (CAS) fires. If time and the situation permit, engage the aircraft with artillery or CAS. An important consideration in determining the manner of engagement is the reaction of the supporting artillery. If available and responsive, by all means use them.

The situation may dictate that you engage the aircraft with your onboard weapons systems capable of defeating the Hind or Hip, ranging from turret-mounted weapons to the tube-launched, optically-tracked, wire-guided (TOW) missile. If the decision is made to engage the aircraft with onboard weapons, the best method of engagement is from the flank. This will ensure that the target presents its largest silhouette while decreasing exposure to the threats onboard weapons. Frontal engagement will increase the enemy's observations of your firing position while simultaneously exposing your aircraft to your adversary's weapons array.

Your survivability and success, when engaging an attack helicopter, will rest almost entirely on your stealth and speed of engagement.

Although we do not expect threat attack helicopters to be restricted to a dedicated role of seeking out and destroying our tactical aircraft, they can be expected to respond to meeting engagements. The increasing numbers of Hind and Hip aircraft will proportionally increase the possibility of encountering threat attack helicopters. This is a fact which must be recognized and dealt with by members of Army aviation.

Questions or comments concerning this article should be directed to Captain Carl Daschke, Threat Branch, Directorate of Combat Developments, ATTN: ATZQ-D-CT, Ft. Rucker, AL 36362; or AUTOVON 558-4709/3512.

Hinds operate in pairs

for mutual security . . .

if you encounter one,

another is likely to be in the immediate area

what's new
In aviation training literature

SQT Help For The 93H/J

2LT David R. Halverson

Course Development Division
Directorate of Training Developments
U. S. Army Aviation Center
Fort Rucker, AL

AN OFTEN ASKED question is, "How can I better prepare myself for the skill qualification test (SQT)?" Well, there is some good news for those who have the military occupational specialty (MOS) of 93H/J.

The second edition of the SQT for MOS 93H/J is in the field. This is a newly revised edition. Testing for MOS 93H began this month and will begin for MOS 93J on 1 November. You should receive the SQT notification booklet from your unit at least 60 days before you have to test. Study the information in the notification booklet carefully. It points out the specific areas (as they relate to the Soldier's Manual) upon which you will be tested. It is your best guide for preparation and success on the SQT.

Another source of information is TEC, which spells out training extension courses. They are multimedia, self-paced, validated lessons prepared to help you do your

Figure 1
Air Traffic Control Extension Courses
(TEC)

	TEC Lesson Number	Title	SM Task No.	Availability
1.	4-222-011-6201-A (Part I)	**Control Information Symbols**	011-145-1030	Oct 1979
	4-222-011-6201-A (Part II)	**Control Information Symbols**		Oct 1979
	Subject: Basic ATC control symbols used on ATC flight progress			
2.	4-222-011-6203-A	**Clearance Abbreviation**	011-145-1030	Oct 1979
	Subject: ATC clearance abbreviations used on ATC flight progress strips			
3.	4-222-011-6204-A	**Miscellaneous Abbreviations**	011-145-1030	Oct 1979
	Subject: Abbreviations used to indicate type of approach requested by the pilot on flight progress strips			
4.	5-222-011-6217-F (Part I)	**Aircraft Identification**	011-145-1021	Oct 1979
	4-222-011-6217-F (Part II)	**Aircraft Identification**		Oct 1979
	Subject: Phraseology used when transmitting aircraft identification over ATC radio and interphone systems			
5.	4-222-011-6219-F	**Radio and Interphone Usage**	011-145-1021	Oct 1979
	Subject: Frequency usage, authorized transmissions and message priority			

6. 5-222-011-6211-F **SVFR Arrival and Departure Strips** 011-145-1030 Dec 1979
Subject: How to fill out SVFR arrival and departure strips using information provided in an ATC tower environment
7. 4-517-011-6006-A (Part II) **Hourly Weather Sequence Reports** 011-145-1018 Oct 1979
Subject: Weather and obstruction to vision symbols
8. 4-517-011-6007-A (Part III) **Hourly Weather Sequence Reports** 011-145-1017 Oct 1979
Subject: Interpretation of sea level pressure, surface wind, altimeter setting and runway visual range (RVR)
9. 4-517-011-6008-A (Part IV) **Hourly Weather Sequence Reports** 011-145-1017 Oct 1979
Subject: Interpretation of NOTAMs, PIREPs and Remarks
10. 4-517-6009-A (Part V) **Hourly Weather Sequence Reports** 011-145-1017 Oct 1979
Subject: Interpret a complete hourly weather sequence report
11. 4-517-011-6012-A **Hourly Weather Sequence Reports** 011-145-1017 Oct 1979
Subject: Interpretation of National Weather Service, Navy and Air Weather Service terminal forecast
12. 5-222-011-6209-F **Introduction to Flight Progress Strips** 011-145-1030 Dec 1979
Subject: Use of flight progress strips, how to make corrections on the strips, use of standard and nonstandard blocks, blocks used for type of aircraft and special equipment designator and block used for aircraft identification
13. 5-222-011-6210-F **VFR Arrival and Departure Strips** 011-145-1030 Dec 1979
Subject: Initiation of VFR arrival and departure strips
14. 5-222-011-6213-F **Clearance Transmissions for Flight Progress Strips** 011-145-1027 Dec 1979
Subject: Receive and relay IFR clearances using standard air traffic control terminology
15. 5-222-011-6214-F **Flight Progress Procedures** 011-145-1030 011-145-1037 Dec 1979
Subject: Initiate, maintain and record IFR and SVFR clearance information on flight progress strips
16. 5-222-011-6215-F **Number Usage** 011-145-1021 Dec 1979
Subject: Phraseology used to transmit serial numbers, altitudes, flight levels, MDA altitudes, DH altitudes, field elevation, altimeter setting, surface wind, headings, runway designations, radio frequencies, speed and miles
17. 5-222-011-6216-F **Facility Identification** 011-145-1022 011-145-1040 Dec 1979
Subject: Phraseology used when transmitting facility identification and operating positions
18. 5-222-011-6220-F **Provide Emergency Assistance** 011-145-1042 Dec 1979
Subject: Determine if a given situation is an emergency, procedures for overdue aircraft, procedures for handling ELT signals, decode emergency information and initiate facility crash net
19. 5-222-011-6212-F **IFR Arrival and Departure Strips** 011-145-1030 Dec 1979
Subject: How to fill out IFR arrival and departure strips, using information provided in an ATC tower environment

---

Figure 2

	PTC* Skill Level 2		BTC* Skill Level 3		Adv NCO Course	Basic NCO Course		* Skill Level 5
	93H20 R14	93J20 R34	92H10 R17	93J10 R37	93H/J40 S12	93H30 R12	93J30 R32	93J50
Subcourses	7	9	9	9	48	35	35	5
Lessons	24	18	18	15	83	75	83	6
Credit Hours	44	45	44	43	230	188	194	77

*Courses which parallel tasks from the Soldiers Manual

job better. TEC can come in the form of audio only (uses a standard cassette tape and player), audio-visual (uses a super eight film loop and cassette tape), and printed text (usually written as programed text). They are short and easy to use, and provide you with the information you need to do well on your job and the SQT. There are a number of these lessons already available to aid you with the common Soldier's tasks. A total of 19 new lessons, specifically for air traffic control, will be available by the end of this year (some of these can be seen in figure 1) on the preceding pages. TEC lessons are available to you at your post's TEC library.

Another way in which you might prepare for the SQT is by enrolling in the Army Correspondence Course Program (ACCP). To date, there are eight correspondence courses for MOS 93H/J personnel. Five of these courses track the tasks from the Soldier's Manual to help you do better on the SQT (see figure 2 located on page 17).

Not only will you be able to do a better job on the SQT, but by completing these courses you also will be better able to accomplish your job.

"What, there is more?" Yes, you can earn promotion points to grade E-6 at a rate of one point for each 5 credit hours satisfactorily completed. These courses with the number of subcourses, lessons and credit hours are listed in figure 2.

No matter what skill level you hold, there is a course designed for you. It is easy for you to enroll: all you need to do is see your unit trainer or the post education officer and submit an application (DA Form 145). Department of the Army Pamphlet 351-20-3, "U.S. Army Aviation Center Correspondence Course Catalog," lists all courses and subcourses (with subcourse descriptions) to help you with your selection.

The Commander's Manual lists the TEC lessons and ACCP courses that will help you to prepare for the SQT. Ask your commander or training NCO for assistance in locating the training materials you need. Prepare now! Remember, preparation is the key to the SQT—the SQT is the key to promotion—and promotion is the key to your career.

OH-58 Kiowa A, C, Aircraft Qualification Course

From the Army Training Support Center
Newport News, VA

Aviators preparing to qualify in the OH-58 Kiowa will be interested in the academic instruction in a correspondence course being compiled at the U.S. Army Aviation Center, Ft. Rucker, AL.

The correspondence course, which will be available in the second quarter of fiscal year 1980, provides the minimum academic training necessary for aviator qualification in this particular observation helicopter.

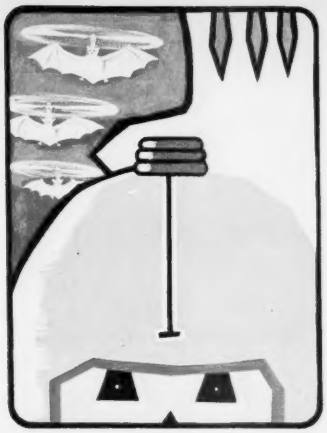
Individual subcourses are those specified in TC 1-137, "Aircrew Training Manual Observation Helicopter," October 1978, and includes the following subjects: Introduction to the OH-58A, C AQC, Structure, Fluid Systems, Flight Controls and Rotor Systems, Mission Employment, Power Plant and Related Systems, Electrical Systems, Weight and Balance and Operational Limitations, Performance Planning, Avionic Equipment, Inspections, Test Flight Requirements, Precautionary Measures and Critical Conditions, and an Operator's Manual Examination.

Completion of 10 hours flight training in their units, as specified in TC 1-137, combined with the academic instruction, will provide aviators with 44 hours of instruction.

Individuals can enroll by submitting a completed DA Form 145, Army Correspondence Course Enrollment Application, to:

Army Institute for Professional Development (IPD)
U.S. Army Training Support Center
Newport News, VA 23628

VIEWS FROM READERS



Editor:

In your article (EPMS Corner dated June 1979) I noted that the 67VNYUX wears two hats, production and quality. My view of the subject is that when you take a supervisor that has a maintenance officer pushing production that a supervisor becomes production minded. In my 10 years of experience I have never seen a maintenance officer yell, "Quality" day after day. Quality is mentioned only after a mistake, and is pushed for a day or so. Then usually in the same breath we want quality but *don't* let production suffer.

I have worn both hats and prefer the one of quality. When quality suffers accidents happen.

SSG Larry A. Cotton
HHT 3rd ACR
Ft. Bliss, TX 79916

Editor:

As a long-time reader of the ***Digest*** I have particularly enjoyed Laurence Epstein's articles on the evolution of aviation logistics. However, please forgive me if I do a little nit-picking.

Epstein, in recounting the arrival of the "new" aircraft during the Korean War states, "Another excellent aircraft, the de Havilland L-20 Beaver (U-6) arrived in *December 1952*." Actually, the L-20 came to Korea several months earlier than that. Captains Tom Hall, Guy Meiss and Carl Colozzi had been trained in Canada to fly the Beaver (Tom was the L-20 test project officer) and had flight-delivered the first production aircraft. Guy "brought" the first Beaver to Korea in the spring of 1952. Almost immediately he began training pilots of the "Dragon Flight," the Eighth Army Flight Detachment, stationed at the old race track airstrip in Seoul. In the meantime, Carl was assigned to the 3rd Infantry Division Light Aviation Section (the first truly consolidated division level Army aviation "company"). Because of this presence, the first L-20 assigned to a combat unit came to the 3rd Division. "Frenchy" Fournier and I were among the first pilots trained by Carl Colozzi and we were in "hog heaven" flying that big powerful bird.

Interestingly, division, corps and the Eighth Army commanders did not share the aviators' enthusiasm about flying in the Beavers. Somehow there was more prestige to be found in the privacy of an L-19 (0-1 Bird Dog). Then, too, the L-19 could get in and out of shorter, narrower places than could the "lumbering" L-20. At any rate, very senior people assigned to or visiting Korea continued to be flown in L-19 and H-13 (OH-13 Sioux) "limousines"; the Beaver was our "bus."

As I recall, by December 1952 there were several Beavers in Korea—and one L-23 (U-8 Seminole), flown by the late and great CPT Jim Lefler—three or four of which were assigned to the Dragon Flight. Nevertheless, when President-elect Eisenhower paid his pre-Christmas visit to Korea in that year, he and every one of the very senior officers accompanying him made all their trips in L-19s. It read like who's who:—Omar Bradley, Radford, Mark Clark, Ridgway, etc.—what a line of Bird Dogs climbing out of the smoky Seoul morning smog! The considerable press corps flew ignomiously in every Beaver that could be gathered. For the record, LTC J. Elmore Swenson flew General Eisenhower in those days. Hugh Gaddis and I leap-frogged from one destination to another in H-13s. Our mission was to dash in, pick "Ike" up and hide him somewhere in the hills in case of a Chinese/North Korean air attack.

A few days later, Billy Graham and Cardinal Spellman came to conduct front-line Christmas services. They hadn't heard about the "prestige" of the L-19 and were delighted at the dignity afforded by wooden steps that were quickly fabricated and brought to the passenger door of the Beaver. All we needed were stewardi—darn it!

COL Colin D. Ciley Jr.
U. S. Army, Retired
805 Northside Dr.
Enterprise, AL 36330

Editor:

An open question to those responsible for UH-60 mission planning—what has happened to the door gunner? We learned in Vietnam that the crew for a UH-1D/H was four. I keep reading about the UH-60 and its crew of three plus 11 combat troops (see page 23 of the May ***Aviation Digest***). If you want to tell me that one of the 11 combat troops is going to be the gunner, then I ask, what happens in the LZ? Does the gunner wire his M60 trigger in the pulled position and jump out with the squad? Seriously, to be a door gunner requires some special training. He is a key member of the crew responsible for maintenance of the guns and he helps the crewchief maintain the ship. When can we push politics aside and admit that the UH-60 requires a crew of four?

CPT Victor A. Lent
Army Aviation Support Facility
District of Columbia National Guard
Davison U. S. Army Airfield
Ft. Belvoir, VA 22060

Load 'Em Up. Co. A, 327th Infantry troops load onto UH-1 Huey helicopters to move out on a live fire air assault at the north impact area

Air Attack

Bringing The Birds. PFC Louis Earles, Co. A., 327th Infantry, flags in the UH-1 Huey helicopters to the pickup site as the rest of his company waits in the grass off to the left and right

Dean Fletcher

101st Airborne Division (Air Assault)
Public Affairs Office
Fort Campbell, KY

THICK CLOUDS of artillery smoke hang deathly over a bombed-out field. Suddenly, 15 roaring helicopters streak across the horizon with their door gunners firing up the tree line.

They land.

In the bat of an eye, a platoon of camouflaged infantry pours out of the choppers and races with blazing weapons toward the woods to meet the enemy.

This war scene is precisely the drama created by the 101st Airborne Division's concept of air assault. The scene recently became reality

at Ft. Campbell, KY, at the north impact area . . . became reality with real bullets.

Soldiers of Companies A and B, 2nd Battalion, 327th Infantry took part in the first tactical live fire air assault at Ft. Campbell since the "Screaming Eagles" return from Vietnam, according to Lieutenant Colonel Clifton Franks, 2nd Battalion commander.

Combat air assault is nothing unusual for the 101st. Air assault is the heart, the "meat and potatoes," of the division's purpose. But the air assault had an added touch when live ammunition was used.

"It was a good exercise," said Captain James Gibson, Company A commander. "Anytime you can get the Soldiers out there firing real bullets instead of blanks, it adds to the learning and enjoyment of the exercise.

"It also puts more stress on the noncommissioned officers and platoon leaders as the threat of something serious happening increases with the use of live ammunition," Captain Gibson continued.

The air assaults were planned to stopwatch precision. The same precision that would be needed in actual combat. First, the 2nd Squadron, 17th Cavalry performed visual reconnaissance of the landing zone. Battery A, 2nd Battalion, 31st Field Artillery unleashed 105 mm and 155 mm howitzer fire on the landing zone.

The artillery fire lasted 6 minutes. As the smoke was clearing, three AH-1 Cobra gunships from Company A, 229th Attack Helicopter Battalion, flew over the landing zone firing 20 mm ammunition at the targets.

On the Cobras heels came 15 UH-1 Hueys from Company C, 158th Aviation Battalion with a company of infantry. The 327th troops riddled the woods with M-16, M-60 machinegun, mortar and antitank fire. The infantry company stayed on the ground for almost an hour before the Heuys returned to pick them up.

Getting Ready. SP4 Julian Garvin, Co. A, 327th Infantry, second platoon, loads his M-16 magazines with live ammunition

"It was all a pretty good first cut," said Brigadier General William C. Louisell Jr., assistant division commander (operations), who was on hand to observe the exercise.

The live fire air assault exercise was carried out twice by the 327th Soldiers. Alpha Company launched the first assault with Bravo Company's assault coming 3 days later.

In Battle Heat. Smoke fills the air as 2LT Robert Olds (right), Co. A, 327th Infantry, signals his troops to move forward. In the foreground SGT John Bigham uses PFC Gerald Riggs' radio

Directorate of Evaluation/Standardization

REPORT TO THE FIELD

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362; or call us at AUTOVON 558-3504 or commercial 205-255-3504. After duty hours call AUTOVON 558-6487 or commercial 205-255-6487 and leave a message

What's In A Chart?

WHAT'S IN A chart? If this question refers to a helicopter performance chart in the new format, the answer is, "a lot." The new performance charts provide a wealth of information that has never before been available to aviators for use in optimizing Army aircraft operations. They give aviators virtually unlimited flexibility for determining aircraft performance capabilities and limitations.

A good example of the variety of information appearing in the charts is cruise performance. In the past the only airspeeds for which power required and fuel flow information was given were maximum range and maximum endurance. Now, aviators can find information for all cruise speeds up to Vne. Other information that can be derived from the cruise charts is fuel flow for any given power setting; conversion of indicated airspeed to true airspeed and vice versa; changes in fuel flow with engine bleed air/anti-ice on and off; Vne; maximum endurance/rate of climb/range airspeeds; excess torque for rate of climb; torque limits and torque available; and allowable gross weights for specific conditions.

Some of the most significant features are:

- Charts are arranged in a sequence that requires a minimum amount of cross-referencing for most situations.
- Old type charts that have no place in performance planning have been removed from the new manuals, e.g., horsepower/torque conversion table, density altitude chart and standard atmosphere chart.
- Color has been added to better portray the areas in which performance is restricted.
- All charts are based on pressure altitude and temperature to eliminate the need to convert to density altitude. This also shows vividly that density altitude is not a good performance indicator.

A brief look at the charts shows the variety of information available for performance planning by Army aviators.

- **Torque Available:** Presents power available in the terms reflected on the instrument panel which, in most cases, is torque—not horsepower. The limitations imposed on the use of torque are shown. For example, the UH-1H Huey chart shows a calibrated torque limit of 50 pounds per square inch (psi), beyond which no information is presented. The chart that shows the 30-minute operating limit reflects values based on the exhaust gas temperature (EGT) limit (yellow range 610 degrees to 625 degrees Celsius). This tells aviators that they can anticipate the EGT being in the yellow range when maximum torque available (less than 50 psi) is used. Additionally, if the maximum torque available (30-minute operation) is less than 50 psi calibrated torque, revolutions per minute bleed-off may be experienced if collective pitch is increased

above that value. These charts also depict the differences in calibrated torque and indicate torque for individual engines when the difference is significant.

• **Hover:** Using the maximum torque available derived from a previous chart, aviators can determine maximum hover height for an estimated gross weight or maximum gross weight for a desired hover height. Hover performance estimates reflecting changes in pressure altitude, temperature and gross weight can be made for all phases of a mission. The hover power check, based on the predicted values from this chart, tells the crew if the aircraft is performing as estimated and if flight should be attempted.

• **Takeoff:** These charts show the distance to clear obstacles and are based on the hover capability determined previously. The optimum airspeed is shown in the top part of the chart while various climb airspeeds are shown in the lower section. Comparisons of the effects of differences in airspeeds and hover capabilities can be made. Also noteworthy is the significant differences in performance for the two techniques—level acceleration and climb acceleration.

• **Drag:** This chart, when used in conjunction with cruise charts, shows the effects on power required, fuel flow and airspeed with various external stores.

• **Climb Descent:** The top portion of the chart shows the rate of climb/descent for changes in torque. This information also must be used with cruise data. The most significant information shown on the bottom portion of the chart is the effects of airspeed on autorotation performance. The chart shows the area where powered flight may not be possible for specific airspeeds and approach angles. In practical terms, it tells the pilot that as angles increase, airspeeds used for the approaches become appreciably more critical.

• **Idle Fuel Flow:** This chart shows the fuel flow for two conditions and allows the crew to determine if the helicopter should be shut down or idled while waiting for loading/unloading, flight clearances, etc.

Examples have been provided to aid the user in determining aircraft performance. Since the number of examples in the Operator's Manual must be limited because of the tremendous volume of information that can be derived from the charts, it is essential that units conduct formal training on their use.

EAGLE SAVE

Ft. Campbell Soldiers load one of four Huey helicopters onto an Air Force C-5A Galaxy transport aircraft during deployment operations for the Dominican Republic early Labor Day morning

ABOUT 60 "Screaming Eagle" Soldiers arrived in Santo Domingo on 3 September to provide help to the disaster stricken people of the Dominican Republic.

Following close on the heels of the Hurricane David's ravaging forces, the 101st Airborne Division Soldiers left Campbell Army Airfield, Ft. Campbell, KY, early Labor Day morning . . . destination . . . De Las Americas International Airport on the Caribbean island.

Working through Labor Day's early morning hours, crews loaded four UH-1 Huey helicopters, four trucks and other necessary equipment onto an Air Force C-141 Starlifter and a C-5A Galaxy.

The flight route to the Dominican Republic avoided Hurricane David and lasted about 4 hours.

Troops from the 101st Aviation Battalion, 426th Supply and Services Battalion, Division Pathfinders and Division Support Command went as a self-sustaining task force. As such, they took a petroleum laboratory team for testing aircraft fuel and a water purification team to ensure the Soldiers have available drinking water while in the Republic.

Plans call for Task Force "Eagle Save" to remain in the Republic for about 2 weeks conducting disaster reconnaissance and providing aid wherever and whenever possible. [PAO, 101st Airborne Division (Air Assault)]

Fort Rucker Doctors Aboard

CH-47 Deployment

Betty Goodson
Public Affairs Office
Fort Rucker, AL

Major Whitehurst in front of CH-47C Chinook

THE CONCEPT HAS been proven by Operation Northern Leap—CH-47C Chinook helicopters can get from the United States to Europe under their own rotors.

Four of the tandem rotor helicopters did it in August, and two of the people involved in the 6,000-mile trip were from the U.S. Army Aeromedical Research Laboratory at Ft. Rucker.

Major (Dr.) Lawrence R. Whitehurst served as an evaluator and a flight surgeon and Major (Dr.) Aaron Schopper as a psychologist.

Sponsored by the Army Training and Doctrine Command, Ft. Monroe, VA, the operation's purpose was to evaluate the Chinook's self-deployment ability. It is believed that such deployment will be essential if the Army's aviation resources are to be used successfully in any future European conflict.

The helicopters, accompanied by an Air Force fixed wing support aircraft, left Ft. Carson, CO on 6 August and arrived in Heidelberg, Germany on 20 August. En route stops were made in Iowa, Pennsylvania, Maine, Canada, Greenland, Iceland, Scotland and England.

Each Chinook carried three pilots, two crewchiefs and an evaluator.

Eight of the pilots, including the exercise commander, were from the 179th Aviation Company at Ft. Carson, as were all the crewchiefs. The other aviators were Army National Guard troops from Stockton, CA, and Army Reservists from Everett, WA.

In addition to Major Whitehurst, evaluators were two majors from the U.S. Army Transportation School, Ft. Eustis, VA, and a Canadian Forces officer.

As the crews' physician, Major Whitehurst said there were few medical problems. Personal stress and fatigue were two areas the evaluators checked closely, and Dr. Whitehurst said the test aircraft had the minimum crew that could accomplish such a mission without being subjected to undue strain.

He said the average flight period lasted 5½ hours, except for the leg from Iceland to England which took almost 9 hours, including a refueling stop in Scotland.

That portion of the trip, according to the doctor, also covered about 700 miles of water and is the longest overwater crossing an Army helicopter has made.

Further data on the crews' attitudes and stress will be obtained when the results of Dr. Schopper's psychological tests are analyzed.

The psychologist, who made the trip in the support airplane, performed tests before the start of the mission and then conducted brief interviews and testing procedures at stopover points.

Having the Chinooks go for extended periods of time at high gross weights resulted in a plague of maintenance problems caused by vibrations, Major Whitehurst said. And a few times the trip had to be delayed while parts were flown to them.

Major Whitehurst was awarded the Air Medal for Operation Northern Leap, and Major Schopper received the Army Commendation Medal.

MODERNIZED COBRA

The following 20 pages are an update of the three AH-1S Cobra modernization series the *Aviation Digest* carried in January, February and March 1978. This series is the most popular ever carried by the *Aviation Digest*. We have received requests for thousands of copies or reprints of the articles. The requests have been picking up as the S models begin to peak out reaching Army units worldwide. This update would not have been possible without the enthusiastic support of the Cobra Project Manager, Colonel Jay W. Pershing, and his staff and of Bell Helicopter Textron. The *Aviation Digest* sincerely thanks all concerned in behalf of all of its readers.

CURRENT AH-1 EVOLUTION PLAN

290	100	98	99
MODERNIZED AH-1S	PRODUCTION AH-1S	UP-GUN AH-1S	MODERNIZED AH-1S
Modified from existing AH-1Gs	Low glint canopy New instruments New blade at #149 Radar warning CONUS Nav radios RAM improvements	20mm cannon Stores management 10 KVA alternator	Laser rangefinder Laser detector New fire control IR jammer New IR suppressor Doppler Nav New transponder and secure voice

Figure 1

MODERNIZED

FIELDING THE AH-1S Cobra TOW antiarmor attack helicopter to operational units has been a tremendous success. The combination of proven technology, coordinated management and professional introduction speaks for itself. This new helicopter has been demonstrated to several European countries and at the Paris Air Show. In each case, its capabilities have generated enthusiastic aviator response and positive command interest.

The first ship of the 297 new production aircraft was delivered to the Army in March 1977, with final delivery scheduled for February 1981. As these new helicopters are delivered from the production line, they will be issued initially to FORSCOM CONUS units. This fielding began in August 1977 at Fort Bragg, NC with the assignment of aircraft to the 82d Airborne Division.

This article, the first of a three-part series, addresses the scope of the Cobra program and highlights the improvements that have been or will be accomplished within the next few years to modernize fully the AH-1S Cobra TOW antiarmor attack helicopter. The second and third parts of this series will cover the new turret and weapons programs and the fire control, aircraft survivability and laser rangefinder/tracker programs, respectively.

MODERNIZATION ACCOMPLISHED IN PHASES: Improvements to the AH-1S new production aircraft will be accomplished through phased product improvement programs. The configuration changes and phasing for the Cobra fleet evolution to modernized AH-1S is summarized in figure 1. The first 100 aircraft produced will feature a new canopy and cockpit, a new T703 engine, uprated transmission plus im-

GLOSSARY

ADF	automatic direction finder	ILS	instrument landing system	TOW	tube-launched, optically-tracked, wire-guided
AM	amplitude modulation	KHz	kilohertz	TSU	telescopic sight unit
CONUS	Continental United States	MHz	megahertz	UHF	ultra high frequency
ECU	environmental control unit	NOE	nap-of-the-earth	VHF	very high frequency
FM	frequency modulated	NVG	night vision goggles	VOR	VHF omnidirectional range
FORSCOM	Forces Command	RAM	reliability, availability and maintainability	VSI	vertical situation indicator
HSI	horizontal situation indicator	SLAE	standard lightweight avionics equipment		
IFR	instrument flight rules				

Figure 2 — AH-1S new production Cobra with IR paint

COBRA

Colonel Jay W. Pershing
Project Manager, Cobra, TSARCOM
St. Louis, MO

Figure 3 — pilot station instrument panel and consoles

proved survivability design features and reliability, availability and maintainability (RAM) characteristics.

Figure 2 is the new production AH-1S Enhanced Cobra Armament System (ECAS) configured Cobra. The new improved main rotor blade developed by Kaman Aerospace Corporation was installed in April 1979 on the 149th production helicopter. The Air Cavalry Troop at Ft. Bliss, TX received the first AH-1Ss with this new improved main rotor blade. A new wing stores (2.75 mm rocket) management subsystem and a universal turret capable of accepting 20 or 30 mm weapons was cut into the production line in September 1978 with the delivery of the 101st aircraft. A new fire control subsystem consisting of laser rangefinder, ballistic computer, low airspeed sensor and a heads-up display will be installed on the 199th aircraft which is scheduled to be delivered in November 1979.

CANOPY AND INSTRUMENT PANELS: The production AH-1S model has a new outward appearance with its nearly flat canopy. This canopy has seven planes of viewing surfaces designed to decrease the glint signature and reduce the probability of visual detection during NOE flight. Another advantage of the new canopy is additional headroom for the pilot's visibility in NOE flight.

The cockpits of both the pilot and copilot/gunner have been redesigned with a new instrument panel to provide for crew efficiency during NOE and IFR flight. Figure 3 is the pilot's new instrument panel. The major improvement in this panel is the grouping and the size of the instruments. The torque meter, pilot steering indicator and radar altimeter are the primary tactical instruments used by the pilot to accomplish the antiarmor mission. These three instruments are located in the center of the panel, under the glare shield, and are 3-inch diameter in size. They facilitiate NOE flight and maneuvering of the helicopter into position for firing the TOW missile and keeping it within maneuver limits until missile impact.

Flight instruments are arranged in a standard IFR "T" configuration comprised of 4-inch diameter VSI and HSI grouped with 3-inch airspeed, altitude and vertical speed indicators. The number of engine instruments is reduced by using dual scale 2-inch instruments where possible. All instruments are equipped with wedge glass to distribute red lighting evenly over the instrument. The dial range markings, numerals and letters are designed to be readable under extremely low light red illumination and when using night vision goggles.

The instrument lighting switches are located on the left side of the panel and provide selective illumination of related instruments for engine, flight, tactical and console groups. The light intensity is rheostat controllable and a toggle switch is provided to the pilot and copilot for returning lighting to the panel if the NVG lights malfunction.

NEW INSTRUMENT CAPABILITY: In addition to the grouping of the instruments on the panel, there are several new instruments that have been added to improve the effectiveness of the AH-1S helicopter. The *radar altimeter*, one of the three primary tactical instruments, provides the crew the ability to fly safely at NOE during periods of poor visibility. The APR-39 radar warning receiver — a survivability improvement — is simple and lightweight, capable of being used during low level and NOE operations. This device provides the pilot sufficient warning in time to take evasive action before receiving fire from radar directed enemy antiaircraft weapons. This warning is provided through an audio and a visual display in the form of a strobe line on a cathode ray tube.

HSI and VSI. These two instruments provide a system that makes precision IFR flight and ILS, VOR and ADF approaches as natural in helicopters as it has become in fixed wing aircraft. Growth capability has been incorporated for future navigation systems such as doppler and flight director computers.

Copilot Panel. Figure 4 on the facing page shows the arrangement of the instruments used by the copilot/gunner. These flight instruments also are grouped in a standard IFR "T" configuration located on the right side of the panel and are all 3-inch diameter in size. A standby magnetic compass is mounted above and on the right side on the copilot/gunner panel glare shield. All of these instruments are marked and lighted as the pilot's. The eyepiece for the TSU is in the center of the cockpit and is used by the copilot to locate the target and guide the missile on to the target during the firing sequence.

An ECU has been redesigned for the AH-1S. The distribution ducts and plumbing for ventilating and environmentally conditioning air within the crew compartments have been modified and rerouted to adapt to the new cockpit configuration.

IMPROVED MAIN ROTOR BLADE: A new composite main rotor blade has been developed by Kaman Aerospace Corporation for use on the AH-1S. It has been designed to be used on the existing airframe without modifications to the AH-1S or its rotor system. It was installed in April 1979 on the 149th new production ECAS helicopter which was fielded at Ft. Bliss in June 1979. This new blade provides improved flight performance, survivability features and RAM, while reducing the radar cross section and acoustic detectability signatures. Figure 5 shows the new blade installation on the AH-1S new production ECAS helicopter. The chord of the blade is 30 inches wide with the outboard.

Figure 4—copilot/gunner station instrument panel and console

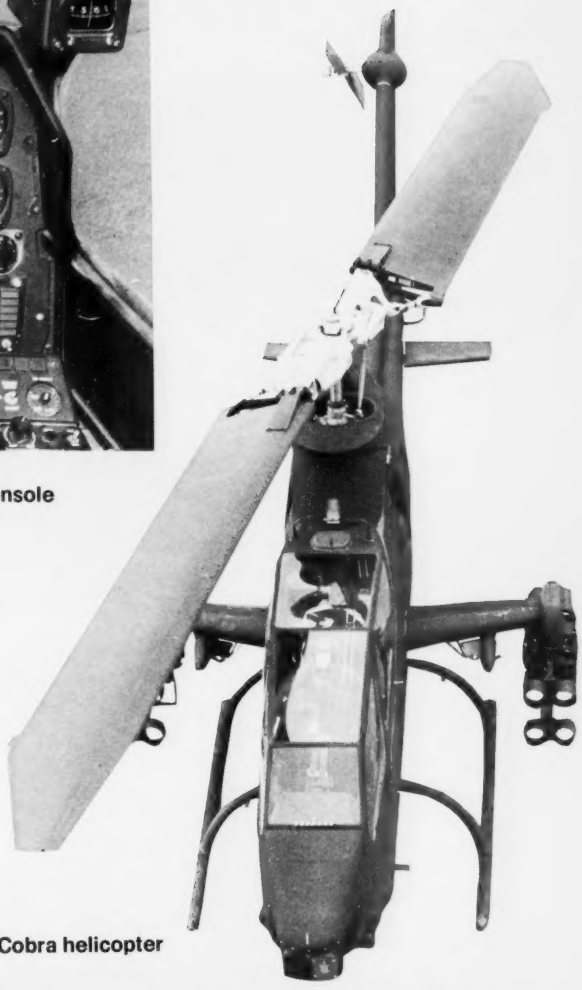


Figure 5—improved main rotor blade installed on AH-1S Cobra helicopter

15 percent tapered in both chord and thickness.

Figure 6 shows the tapering effect of the new blade and compares it to the present metal blade. The new blade has been designed for almost total repairability of the skin and core aft structure by personnel in field units. This is accomplished with the aid of a heat-pressure pack tool, shown in figure 7, which can accomplish the repair of the blade without removing it from the aircraft. A survivability feature of the new blade will allow 30 minutes of flight after being hit with a single 23 mm high explosive, incendiary, tracer round and is invulnerable to a single hit 12.7 mm round. The "through damage," which would result from this type of a ballistic hit involving both skins and the core, can be repaired by personnel in the field in less than three hours. The maximum allowable operating time for the new blade is 10,000 hours which is an increase of 9,000 hours over the present metal blade.

CANOPY ESCAPE SYSTEM: A new crew compartment escape system provides a means of escape for the pilot and copilot/gunner in emergency situations where normal egress is not possible. Operation is accomplished by a ballistic jettison system which explosively cuts the acrylic side windows from the canopy support structure while linear shaped charges and thrusters explosively

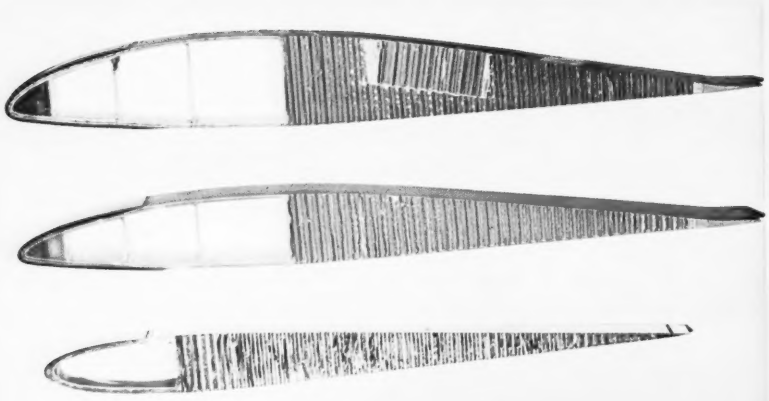


Figure 6 (Left)—inboard and outboard cross sections of improved main rotor blade (top) and outboard cross section of standard metal blade

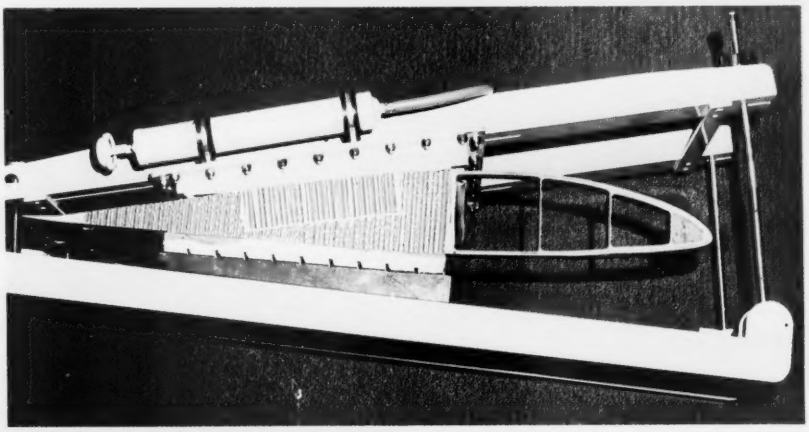


Figure 7 (Right)—heat-pressure pack special tool installed on improved main rotor blade section incorporating repair

Figure 8 (Left)—arming firing handle for pilots canopy removal egress system

separate the pilot and copilot/gunner entrance doors. It is totally independent of the aircraft electrical system or of any external energy source, and can be actuated only from inside the pilot or copilot/gunner station by either of two arming/firing handle mechanisms. Figure 8 shows the canopy removal system components for the pilot station.

Other significant improvements are shown in figure 9 and include:

Hydraulic Pump. An electrically driven pump which takes the place of the collective control accumulator which provides an unlimited number of collective strokes in the event of a main hydraulic system failure. It can be used for boresighting of the turret and TOW missile subsystems without the need of additional ground support equipment (Hydraulic Mule).

Rod End Bearing. An improvement to replace current rod end bearings of the hydraulic servo cylinder connecting tubes which will increase the fatigue life of the bearings to 3,300 hours.

Tungsten Carbide Bearing Sleeves. An improvement to replace main rotor teflon feathering bearing sleeves with a more durable materiel for increasing sleeve life.

Standard Lightweight Avionics Equipment (SLAE):

- *ARC-114 Radio* — An FM communication radio replacing the ARC-54/131. It is a smaller, lighter radio that is compatible with secure voice systems.
- *ARC-164 Radio* — A UHF-AM voice communication radio replacing ARC-51. It performs all ARC-51 functions but is smaller, lighter and compatible with secure voice systems. It provides 25 KHz spacing in the 224-400 MHz band.
- *ARC-115 Radio* — A VHF-AM voice communication radio replacing the ARC-134. It also is compatible with secure voice systems.

CONUS/NAV (ARN-123). Improves the AH-1S navigation capability by adding VOR and ILS receivers, glide slope, marker beacon and indicator lights. The CONUS NAV package is currently included in the production AH-1S; however, future aircraft will not have this package.

Engine Deck Panels. A three piece engine deck designed to reduce bonding separations and provide for replacement of the forward and middle panels by field units. It also includes arms which support No. 1 hangar bearing.

Antitorque Controls. Provides push-pull tubes between tail rotor pedals and tail rotor pitch mechanism thus eliminating troublesome pulleys, sprockets, cables and chains. This improvement is included on the Mod "S" models.

Fire Detection. The system installed in the engine compartment includes a single loop sensing element connected to a control unit which activates fire warning indicators, located on the pilot's instrument panel.

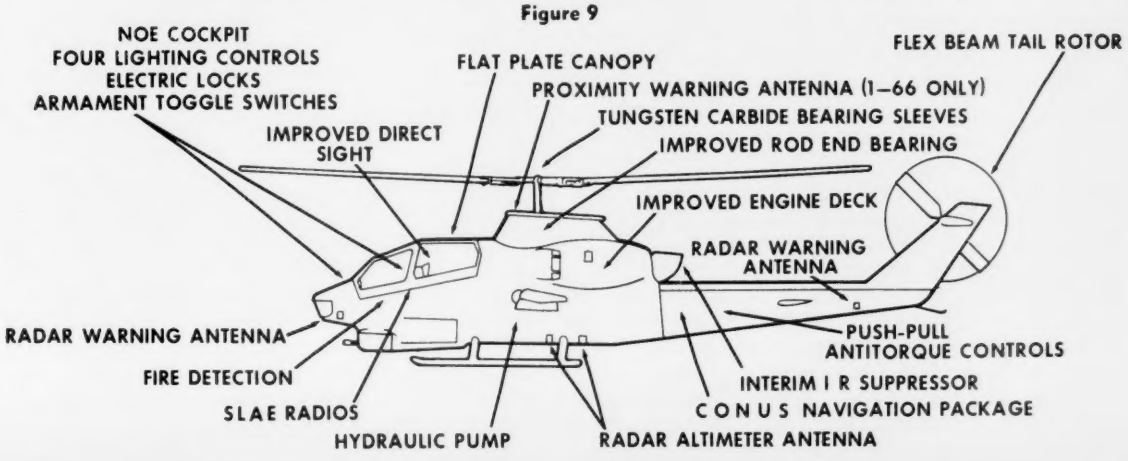
Flex Beam Tail Rotor. A simple uniball feathering bearing with a single piece hub which reduces maintenance and provides better antitorque controllability. This improvement is included on all AH-1 models.

The Cobra attack helicopter has proven itself to be a viable aircraft for today's antiarmor requirement. It also will complement the advanced attack helicopter in the high-low mix of attack helicopters in the U.S. Army fighting force of the future.

The next article on the modernization of the AH-1S will cover the new turret and weapons programs.

PRODUCTION AH-1S FEATURES

Figure 9



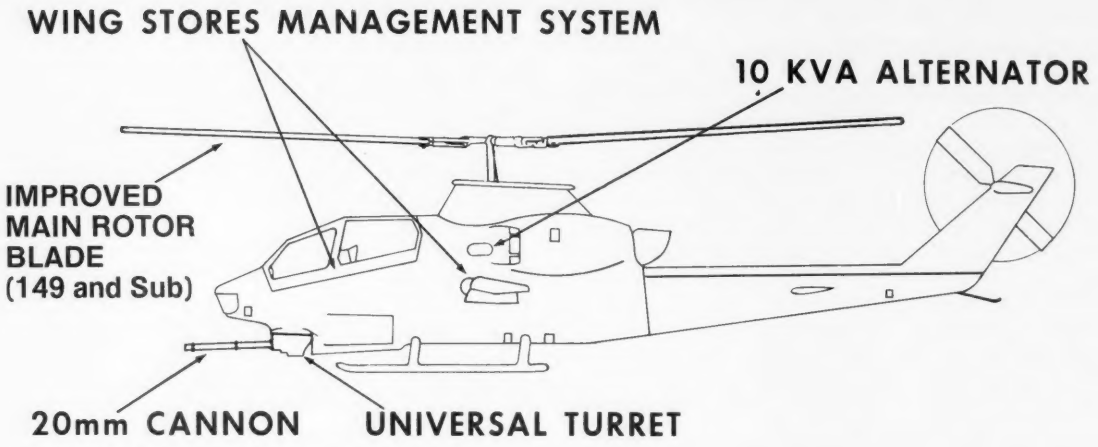


Figure 1—Production upgunned AH-1S features

MODERNIZED COBRA PART II

Colonel Jay W. Pershing

Project Manager, Cobra, TSARCOM
St. Louis, MO

LAST MONTH part one of this article presented an overview of the AH-1 Modernization Program. It focused on the features of product improvements and how the resultant improvements will be incorporated into the Cobra TOW (tube-launched, optically-tracked, wire-guided missile) antiarmor attack helicopter fleet.

This article addresses, in part, the new weapon subsystems which will increase significantly the combat capability of Cobra TOW attack helicopters.

The requirement to modernize and "upgun" the Cobra was defined by a Special Study Group (SSG) during the Priority Aircraft Subsystem Review at Ft. Rucker, AL from November 1974 to December 1975. (See "Pass in Review," April 75 *DIGEST* and "The Upgun Dilemma," May 75 *DIGEST*.)

The SSG, under the direction of the commanders of the U. S. Army Armor and U. S. Army Aviation Centers, was comprised of representatives of TRADOC (Training and Doctrine Command), DACROM (Army Materiel Development and Readiness Command), subordinate commands, the Cobra Project Manager's Office and field commands. Following affordability analyses of the SSG recommendations by the Department of the Army staff, Required Operational Capability (ROC) documents were approved and used as the basis for structuring the current Cobra Modernization Program.

The first major effort to upgun the Cobra attack helicopter was included in the Enhanced Cobra Armament Program (ECAP). Bell Helicopter Textron (BHT) is the prime contractor and system integrator. The program is divided into two phases to best meet the funding and development time frames.

Phase I includes development and qualification of a universal turret to accommodate either the 20 mm or 30 mm weapon system and a Stores Management/Remote Set Fuzing Subsystem. It also will include aircraft interface aspects and the application of additional fiscal year (FY) 78 product improvement programs (PIPs).

Phase II includes the qualification of a new fire control subsystem, the incorporation of additional PIPs and improvements in aircraft survivability equipment. Phase II will be discussed next month in part 3 of this article. Figure 1 summarizes the basic features of the ECAP Phase I Program.

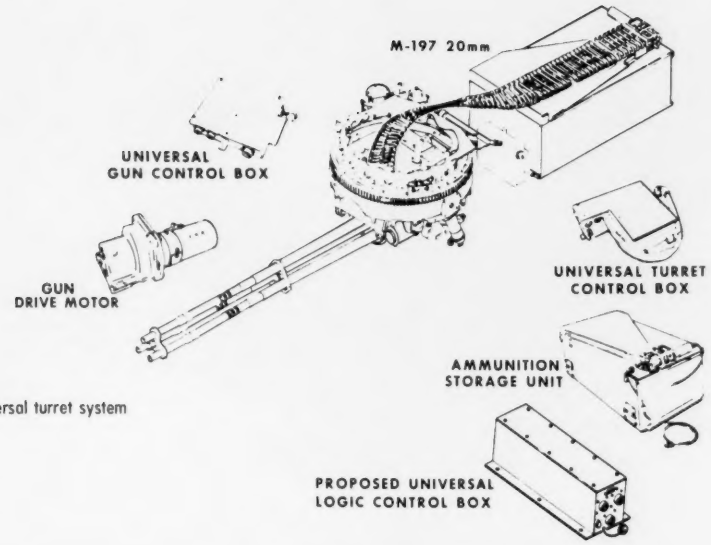


Figure 2— Universal turret system

UNIVERSAL TURRET

The Armament Systems Department of General Electric in Burlington, VT developed and manufactures the universal turrett. The objectives of the Universal Turret Program are to provide an improved standoff capability, improve antipersonnel and antimateriel effectiveness and accommodate either a 20 mm or 30 mm weapon. This new turret eventually will replace the M28 (7.62 mm/40 mm) subsystem now installed in the Cobra.

The 101st new production AH-1S was delivered in September 1978 and was the first to be equipped with the universal turret and the 20 mm, M197 gun. The 30 mm weapon subsystem is still a user requirement, however, final approval for this program has not been obtained. The Universal Turret is electrically powered and has a design weight limit of 175 pounds. The basic components of the system (figure 2) are the turret, linked feed system and three electronics boxes containing the turret, gun and logic controls.

In the AH-1S, the Universal Turret fires through ±110 degrees forward azimuth and has a variable elevation of 20.5 degrees maximum and a depression of 50 degrees maximum. Turret position is controlled by the pilot or copilot through helmet sights or by the copilot through use of the Telescopic Sight Unit (TSU) of the missile subsystem. The turret is electrically driven by two servo motors—one for azimuth and one for elevation. The motors receive position commands from either the TSU or helmet sights and feature quick response and safe, reliable operation.

As previously indicated, the universal turret will accommodate either the 20 mm, M197 Vulcan or a 30 mm weapon. The saddle of the turret is designed to accommodate a 30 mm weapon and the quick release pin mountings of the M197. The ammunition storage container is designed to hold either 20 mm or 30 mm ammunition. Partitions will be added to the container to accommodate the shorter 20 mm round. Ammunition chuting is easily exchanged by using quick release fasteners. The operation of interchanging gun, chuting and feed systems takes less than 30 minutes.

The M197 20 mm gun is shown in figure 3 mounted on the universal turret with its ammunition container. It fires standard M50 series 20 mm ammunition at a rate of 730 ±50 shots-per-minute with an effective range of 2,000 meters. For the AH-1S, the gun is held within the turret by a rear ball mount, a slider, and a low force recoil adapter. The low force recoil adapter reduces the recurring peak recoil load of the gun to about 1,150 pounds.

Figure 3—M197, 20 mm gun with ammunition container

TURRET AND CONTROLS

On the AH-1S, the turret is mounted under the nose of the helicopter, the same as the present M28 turret. The turret contains the components necessary for positioning and firing the gun as directed by the gunner from the sighting station. Positioning of the gun is performed by a gimbal and a saddle which moves the gun in azimuth and elevation respectively. The azimuth and elevation drives are powered by direct current motors through gear reductions. Electrical current for the motors is controlled from the servo amplifiers, located in the turret control box, which use the helicopter's 28 volt DC (direct current) power source.

The turret, gun and universal logic control boxes provide the electronics for all controls and switches in the system.

20 MM LINKED STORAGE AND FEED SYSTEM

A complement of 750 20 mm rounds of linked ammunition is fed to the gun through flexible chuting from the ammunition box stored in the ammunition compartment of the helicopter. During firing, a small booster motor pulls linked ammunition from the box and pushes it into a section of flexible chuting which is connected to the gun's feeder. The booster eliminates excessive belt pull loads, which occur when the belt is pulled on by the delinking feeder, and eliminates the requirement to manually fill the chute during loading.

2.75 INCH ROCKETS

The 2.75 inch rocket subsystem has been one of the primary aerial weapon systems used on the Cobra. It provided valuable support to ground units during the Vietnam conflict.

There are several development programs that have been initiated by the 2.75 Inch Rocket Project Manager to improve the warheads and launchers to be used on the modernized Cobra. The basic 2.75 inch rocket motor and the available warheads are shown in figure 4. The submunitions and chaff warheads are the newest developments in the warhead program.

During the SSG review in 1974-5, the weight of any prospective improvement was a key consideration in structuring the modernized Cobra program. As a result of the weight factor, a requirement for lightweight 7 and 19 round launcher development was established. The design features of these launchers are illustrated in figures 5 and 6.

The Stores Management/Remote Set Fuzing Subsystem developed and manufactured by Baldwin Electronics Incorporated, Little Rock, AR, will use the 2.75 inch warhead and launcher improvements to enable more effective mission accomplishment by Cobra crews. To date provisions only have been provided for this subsystem on the new production aircraft. It is scheduled to be installed on the 199th new production modernized AH-1S to be delivered in November 1979.

The control panel for the stores management/remote set fuzing subsystem is shown in figure 7. The panel will provide the means to select and fire, while in flight, any one of five types of external rocket stores. It will allow the pilot to set range and select the fuze setting best suited to the type target being engaged to include settings which will permit penetration of tree canopies or fortifications protecting selected targets.

Although electrical power requirements for the AH-1S continue to increase, adequate power will be available to operate subsystem changes described in this article, plus several high electric power demand devices forthcoming.

Beginning in September 1978, modifications include the installation of alternating current alternators on the transmissions of all Cobra S models produced.

The weapon subsystems discussed above, coupled with the TOW missile, and the versatility of available ordnance will provide Cobra crews with the required firepower to accomplish missions of antiarmor, direct aerial fire support and armed escort/reconnaissance. The commonality of guns, rockets and missiles will enhance the effectiveness of rearming at forward area rearm and refuel points (FARRPs). The survivability of the crews will be improved greatly with the added standoff capability; the accuracy and effectiveness of the new weapons and ammunition; plus the capability to remotely select the correct fuze setting for the type target being engaged. The enhanced armament subsystems on the modernized AH-1S will keep the attack helicopter a viable member of the Army's combined arms team for many years.

Next month part 3 of the "Modernized Cobra" will cover the fire control, aircraft survivability equipment, laser rangefinder, and the laser tracker programs.

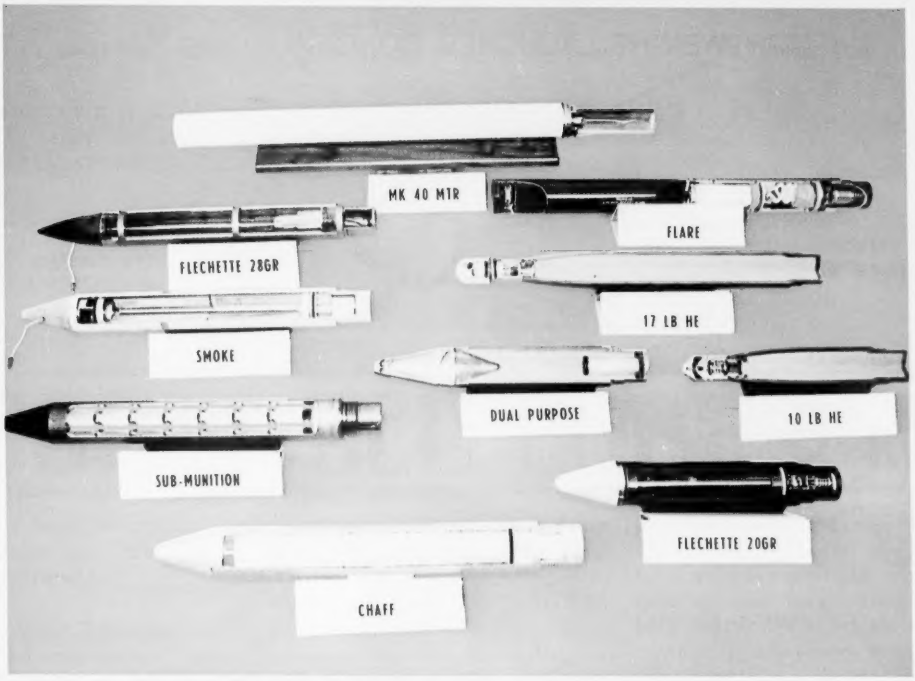


Figure 4—2.75 inch rocket motor and warheads

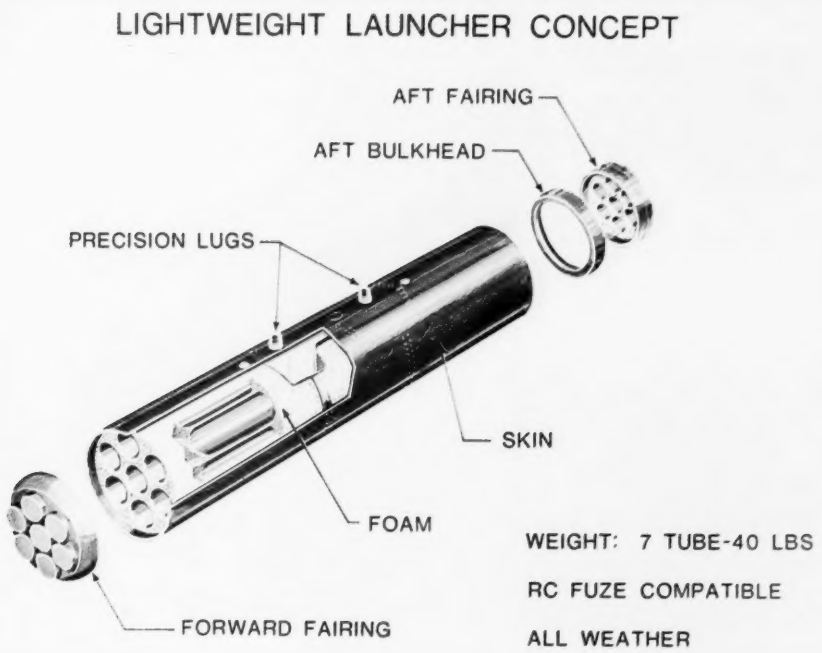


Figure 5—7 round 2.75 inch rocket lightweight launcher

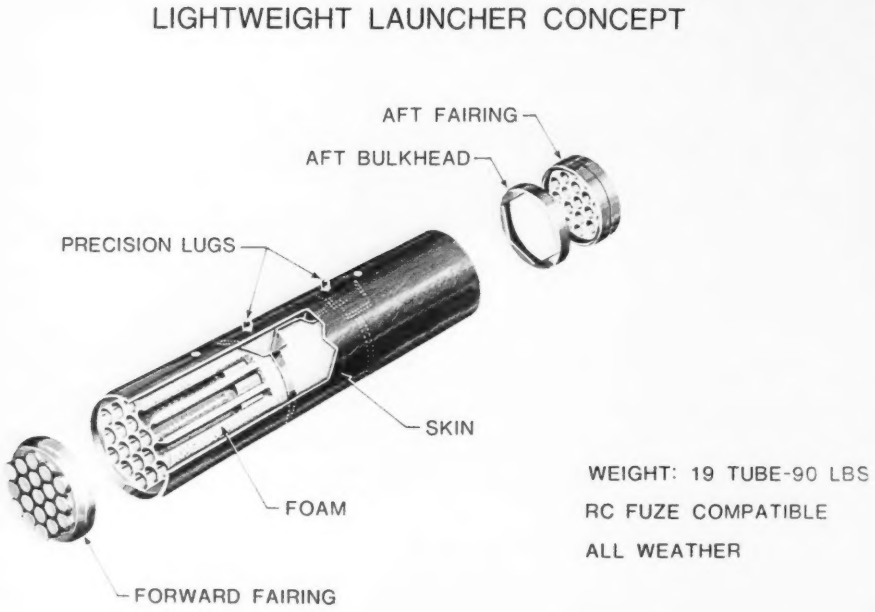


Figure 6—19 round 2.75 inch rocket lightweight launcher

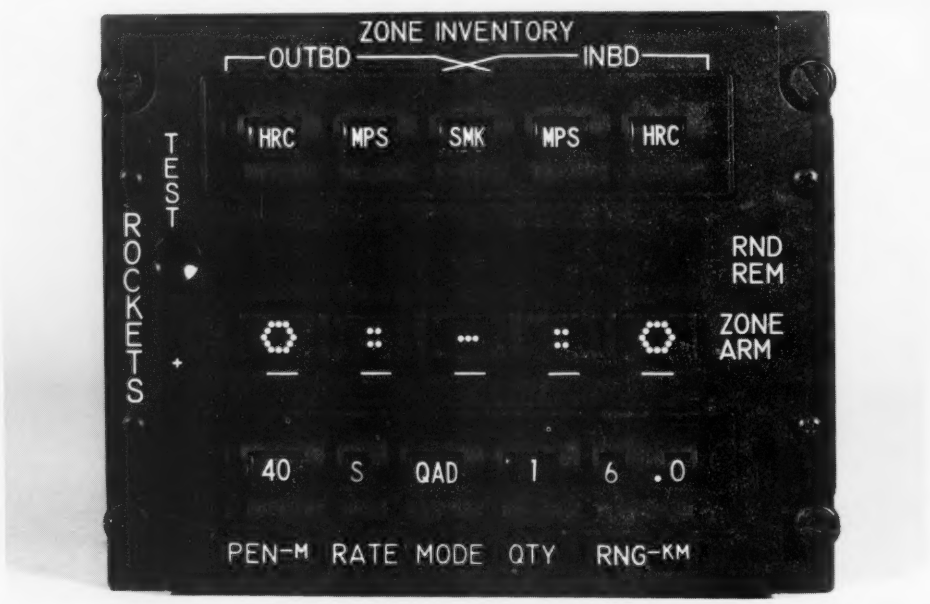


Figure 7—Control panel for stores management and remote fuzing subsystem

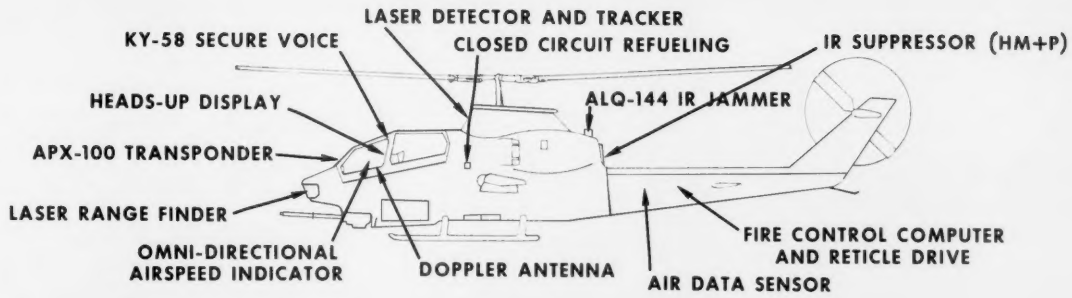


Figure 1 — Modernized AH-1S (199 -297)

MODERNIZED COBRA PART III

Colonel Jay W. Pershing
Project Manager, Cobra, TSARCOM
St. Louis, MO

DURING THE TWO previous series on the modernized Cobra, an overview of the total program and the weapons program have been presented. This article will address the fire control, airborne laser tracker and aircraft survivability equipment programs.

FIRE CONTROL

The fire control subsystem is the major effort of Phase II of the Enhanced Cobra Armament Program (ECAP) designed to upgun and modernize the Cobra attack helicopter. The featues of the new fire control subsystem include a pilot heads-up-display (HUD), fire control computer (FCC), air data subsystem (ADS) and laser rangefinder (LRF). The new fire control is scheduled to be installed on the aircraft to be delivered in November 1979.

Figure 1 shows the configuration changes for the 199th through 297th AH-1S aircraft which will complete the modernization of the Cobra TOW (tube-launched, optically-tracked, wire-guided) attack helicopter.

The HUD, being developed by Kaiser Electronics in Palo Alto, CA, will provide increased weapon delivery capability for both day and night operation. The primary purpose of the HUD is for aiming the aircraft to fire the TOW missile system and other aircraft weapons. It will aid the pilot in navigation and increase flight safety during nap-of-the-earth (NOE) flight. The HUD consists of two line replaceable units, a pilot's display unit and a symbol processor unit (SPU).

The pilot's display unit, shown in figure 2, is mounted on the pilot's instrument panel and presents flight, target acquisition, and weapon delivery information using a cathode ray tube (CRT)/optical display. All of the HUD symbology appears in the pilot's normal field of view.

Weapons systems, fire control, flight status and flight control information are displayed, including target acquisition reticles, aircraft boresight reference, and gunner's sighting cues. The fire control data displayed includes aiming and firing data for rockets, guns and TOW missiles and is based upon the weapon type selected by the crew. Also displayed are engine torque, radar altitude, magnetic heading and target range data information. Examples of this symbology are shown in figure 3.

The SPU, which receives and processes inputs from the fire control computer and other aircraft sensors and generates all of the symbology which is displayed on the HUD, is a compact, lightweight electronic unit which is mounted in the aft aircraft equipment compartment.

The fire control computer is being developed by Teledyne Systems Company in Northridge, CA and will provide the gunnery solutions for the turret and rocket weapon systems. It is a general purpose, digital computer which accepts inputs from the universal turret, air data subsystem, laser rangefinder, airborne laser tracker and telescopic sight unit and performs computations that enable the pilot and copilot to deliver accurately ordnance from the turret and rocket weapon systems. Figure 4 shows the computer which will be located in the aft fuselage compartment.

The air data subsystem is being developed by Marconi-Elliott Avionics in Rochester,

England and provides three dimension airspeed, downwash, static pressure and air temperature information to be used by the fire control computer to solve the gunnery problem for increased accuracy of the turret and rocket weapons. The swiveling pitot static probe shown in figure 5 is mounted on the top of the canopy extending out to the right side of the aircraft and is used to gather the data to be sent to the fire control computer.

The primary purpose for the addition of the laser rangefinder into the TOW Telescopic Sight Unit (TSU) is to enhance the ballistic weapons accuracy on the modernized Cobra and increase survivability from enemy fire by allowing the AH-1S to stand off to the maximum range of the TOW missile.

This program is an integration of an existing laser design which has been used in other Army laser systems such as the ground lightweight laser designator (GLLD), XM-1 tank fire control and the Army lightweight target designator (LTD). The TSU provides gunner aiming line of sight angles, rates and laser range to the fire control computer. Other inputs from the data computer and vertical gyro will be used by the fire control computer to compute the weapon lead angles required to minimize the aiming error.

Maintenance features include a laser built-in-test (BIT) which can be performed on the ground with the TSU window cover installed. Since the LRF fault isolation can be performed by BIT at aviation intermediate maintenance (AVUM) and aviation unit maintenance (AVIM), no changes are required to the M65 Test Set, Guided Missile System (TSGMS). Laser malfunctions will require replacement of the TSU.

The LRF can be a hazardous

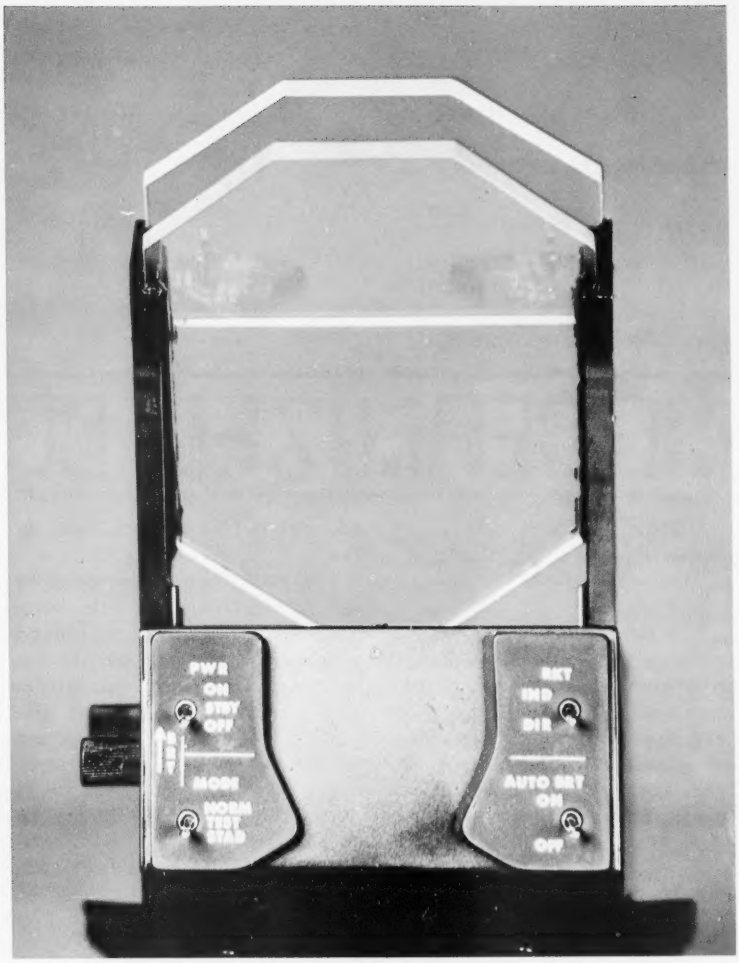


Figure 2 — Pilot's Display Unit

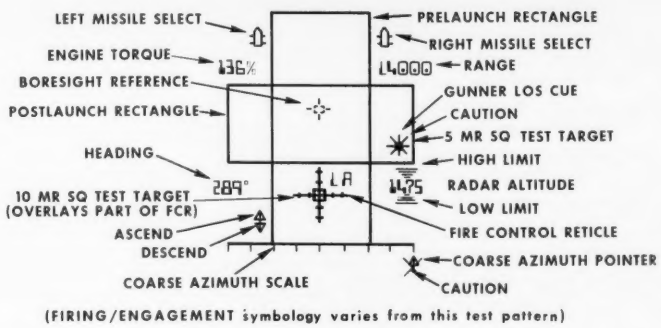


Figure 3 — HUD Test Mode Symbology

device if used indiscriminately on the ground or in the air. Safety features are included to minimize probability of injury to the aircraft crew and ground support maintenance personnel. As an example, the laser cannot be fired when the aircraft engine is not running and when the protective cover is not installed on the TSU window. However, when the protective cover is placed over the TSU window the laser can be fired to perform BIT. When airborne, the laser cannot be fired unless the TSU laser eye filter is switched in place and the laser is armed by both the pilot and the gunner. Figure 6 shows how the laser rangefinder will be installed in the M65 TSU, which will be accomplished by Hughes Aircraft Company.

AIRBORNE LASER TRACKER

The Airborne Laser Tracker (ALT) AN/AAS-32 is an aircraft mounted system designed to automatically search, acquire and track target reflected laser energy. The system was developed in conjunction with the laser target designator AN/PAG-1 (hand held) but is compatible with any laser designator of the same wavelength that employs the Tri-Service pulse repetition frequency (PRF) coding scheme. The AN/AAS-32 major components are shown in figure 7. The ALT will improve target acquisition and provide target hand-off capability for laser designated targets. Provisions only will be accomplished for this system on the aircraft scheduled for delivery in November 1979. A decision to defer installation of the ALT has been coordinated with the commanding generals of the Aviation Center and the Armor Center. It is estimated to be installed in fiscal year 1983.

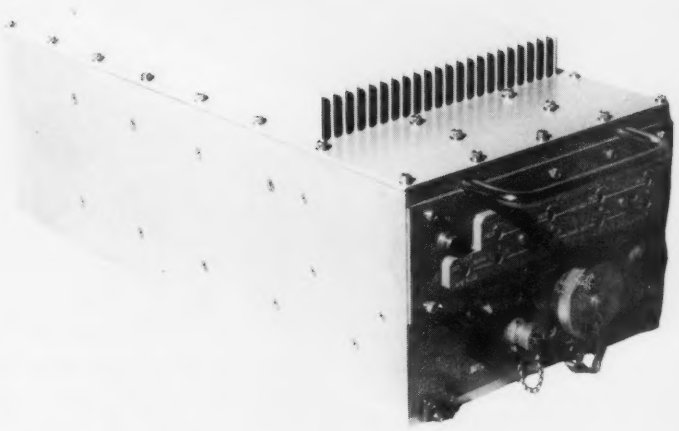


Figure 4—Fire Control Ballistics Computer

Figure 5—Air Data Subsystem Components

AIRCRAFT SURVIVABILITY EQUIPMENT

The Cobra aircraft is one of the most important aircraft survivability equipment (ASE) customers of the present fleet of front line aircraft. In fact, since 1974 intensive programs in infrared (IR), optics, radar, and ballistics survivability have been underway to counter present and projected air defense threats. The results are now evident in the new look of the Cobra weapons platform. The IR suppressors and low reflectance IR paint, flat plate canopy, warning receiver antennae and jammers

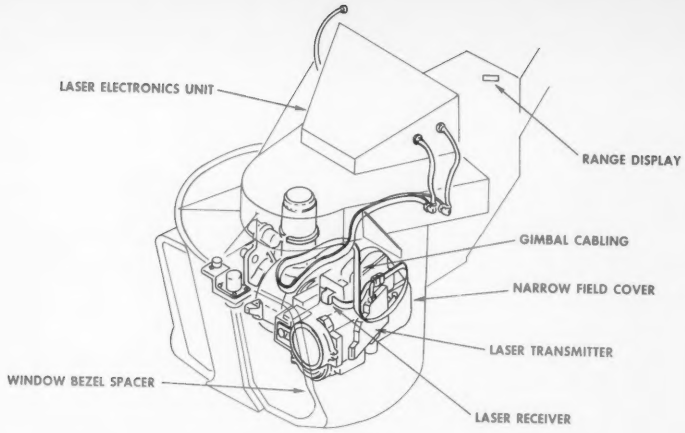


Figure 6—Laser Rangefinder Installation

will complement the advanced weapons, fire control and navigation developments to transfigure the lean AH-1G to the higher powered modernized and survivable AH-1S.

In addition to these hardware improvements, tactics and doctrine have been developed to take advantage of the new weapons capability which will enhance the aviator's ability to survive in combat. Testing and improving of these tactics and doctrine during field exercises has established the credibility that Army helicopters can survive and operate effectively on the modern battlefield.

Infrared Survivability. IR suppressors and paint are used to reduce the AH-1S signature sufficiently to operate against the less sophisticated missiles. During 1976 and early 1977, the bell scoop IR suppressors and IR paint were applied to the Cobra/TOW helicopters in Europe, Continental United States, Hawaii and Korea. The scoop weighs 40 to 45 pounds and shields the hot metal parts from view of the IR missile. IR paint has been adapted as the standard Army paint and is being applied routinely on production, overhaul and modification lines. For advanced threats, an improved IR suppressor, which reduces hot metal plus plume (HM + P) signature is required. It reduces the effective range of the more sophisticated IR missiles and makes it feasible to employ an efficient IR jammer.

The AH-1S suppressor program is now in the latter stages of engineering development and scheduled for production in 1979. It is a cooled plug-type suppressor and the design uses large volumes of ambient air to cool the exposed metal surfaces and to dilute the exhaust gas to lower the plume signature. Figure 8 shows the present bell scoop IR suppressor. Figures 9 and 10 show the new hot metal plus prime IR suppressor.

ALQ-144 IR Jammer. The IR jammer is required to defeat the postulated air defense growth threat. The ALQ-144 weighs 25 to 30 pounds and is an active IR countermeasure which confuses the threat IR missile. Development and operational testing has been completed successfully and production is planned for 1979. The application of the ALQ-144 to the AH-1S will be accomplished along with the new hot metal plus plume suppressor.

RADAR SURVIVABILITY

The AN/APR-39 radar warning receiver (RWR) on the Cobra is a simple lightweight system consisting of five antennas, two receivers, a comparator and a cathode ray display and weighs about 10 pounds. For low level and NOE operations, the radar signal density will be low due to terrain masking, permitting the use of this proven system. The APR-39 provides the pilot with the advantage of being able to take evasive maneuvers before actually receiving fire from radar-directed weapons. The warning is provided to the pilot through an audio tone in the headset and a strobe on the cathode ray tube.

A laser warning receiver, adaptable to the APR-39, is now completing advanced development and is scheduled to enter full-scale engineering development in early fiscal year (FY) 79. It weighs about eight pounds and will display quadrant warning to the pilot that a laser designator or rangefinder is aimed at the aircraft.

The ALQ-136 radar jammer on the Cobra is an automatic radar jammer for attack helicopter use that is passive until illuminated by a threat radar which has locked onto the aircraft. The ALQ-136 automatically causes a breaklock on the threat radar, then returns to the passive mode. It can defeat two threats simultaneously. It is scheduled to be applied to the AH-1S in 1979. The M-130 chaff dispenser is the low cost radar countermeasure solution for the Cobra, pending availability of the ALQ-136 radar jammer. This system has proven its effectiveness, weighs about 30 pounds fully loaded with chaff cartridges and is in production. Provisions for the Cobra weigh 2 to 3 pounds.

OPTICAL SURVIVABILITY

Canopy glint, rotor blades and fuselage color were determined to be major contributions to the visual detection of NOE helicopters. All new production AH-1S have flat canopies and all other Cobras will receive the new canopy during future S model conversion programs. After extensive field testing it was determined that the dark green IR paint on the fuselage and flat black on blades was the optimum paint scheme for Central Europe and Asian theatres. This is now standard paint as described in the IR suppression discussion, above.

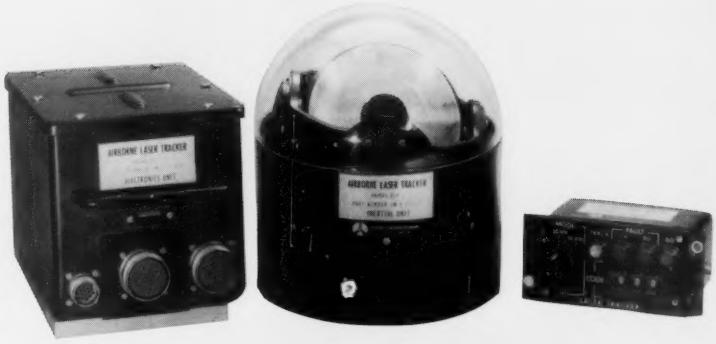


Figure 7—Airborne Laser Tracker AN-AAS-32

BALLISTICS SURVIVABILITY

The AH-1S already has benefitted from vulnerability reduction or ballistics hardening efforts. The new AH-1S tailbooms have been designed to withstand ballistics damage from a 23 millimeter (mm) round. The improved tailbooms will be applied to all conversion Cobra aircraft. The new main rotor blade not only reduces the radar cross section but can withstand a 23 mm round ballistic damage and continue to fly. A new transmission is under development which will be capable of operating for 20 minutes without lubrication should it receive a ballistic hit.

Figure 8—AH-1 with Bell IR Suppressor

Figure 9—Modernized AH-1S with hot metal plus plume IR Suppressor

The Cobra has the best aircraft survivability equipment presently available and active programs to meet the growth threat are being expedited and matched with the aircraft production to minimize cost and modification downtime. The new survivability equipment is being developed for ease of installation through kit design which provides the commander the flexibility to use only the ASE that is needed.

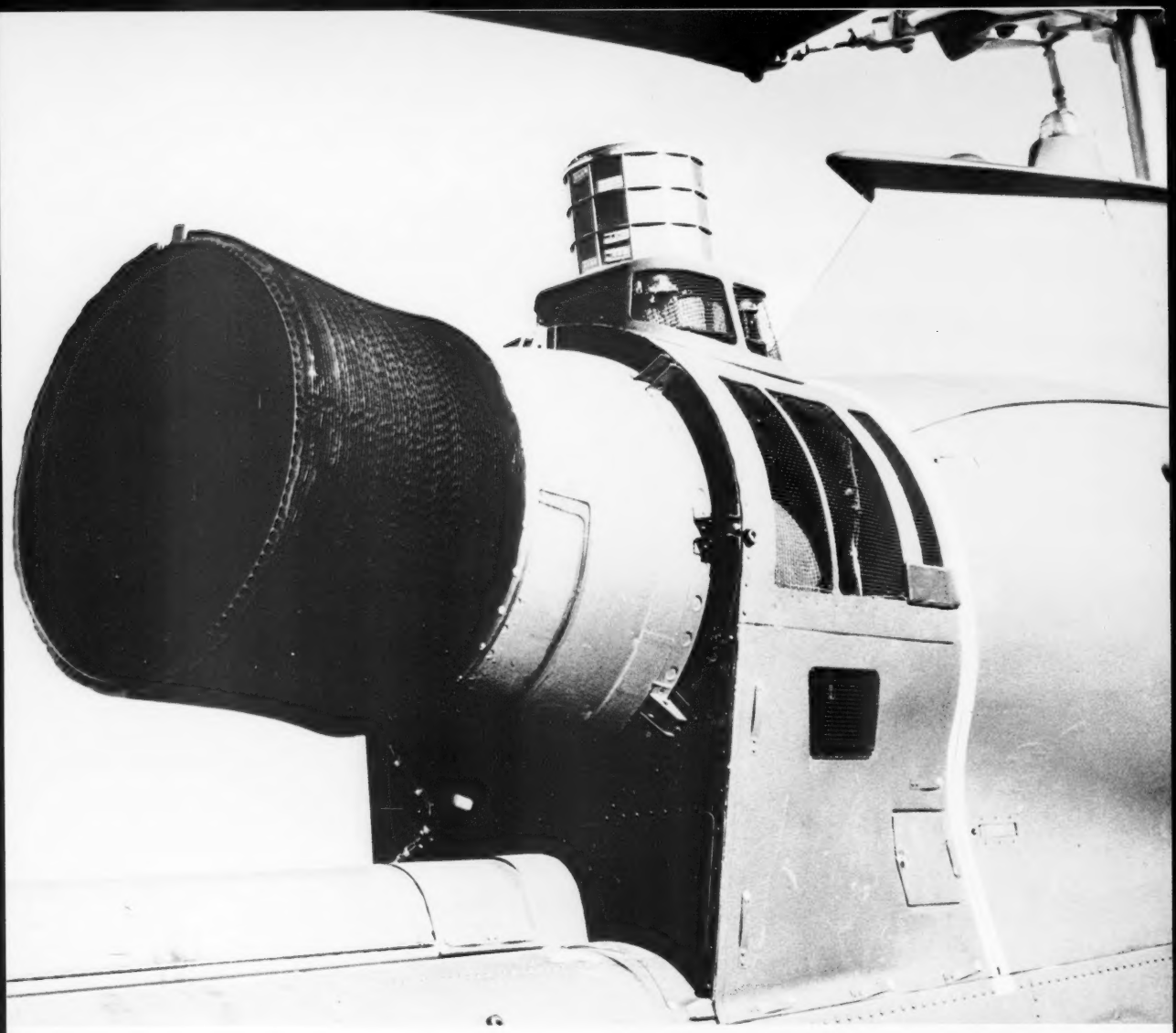


Figure 10—Hot Metal plus plume IR Suppressor and IR Jammer

TECHNOLOGICAL ADVANCES

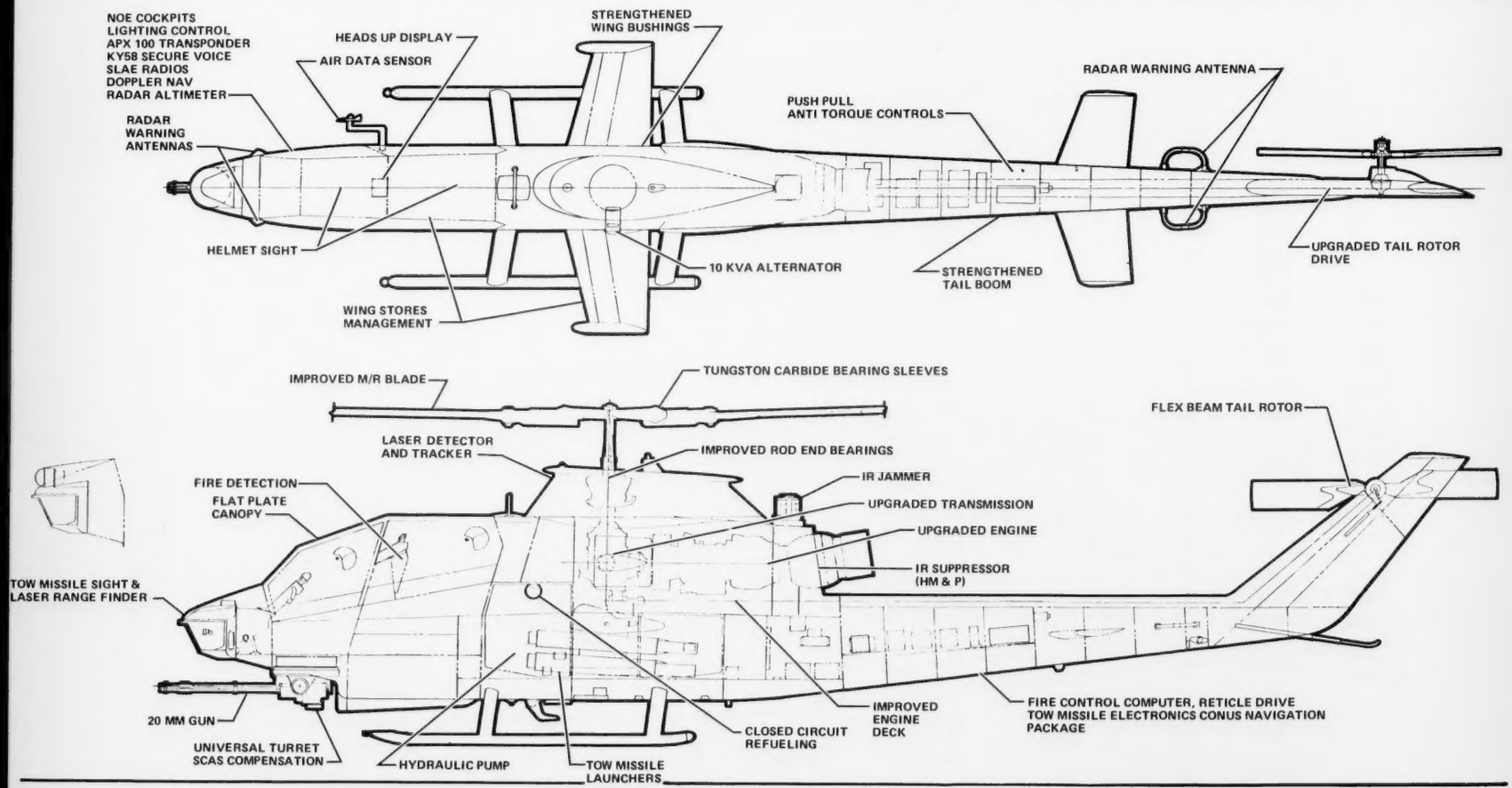
There are several technological improvements being developed which could enhance the AH-1S Cobra TOW navigation, target acquisition and communication capabilities.

A projected map display (PMD) for navigation, a FLIR augmented TOW Sight (FACTS) for high threat acquisition and recognition and a new group of NOE radios for communication with all battlefield elements are possible candidates for additions to the Cobra.

Also, an integrated avionics control system (IACS) which will provide for complete avionics, doppler navigation control and PMD interface. Efforts are underway to uprate the T53-L-703 engine from its present 1,800 shaft horsepower (SHP) to 2,000 SHP to meet the 4,000/95 degrees fahrenheit (F.) hover out of ground effect at max gross weight requirement.

A multiplex system is being investigated which will eliminate more than 100 pounds of wire bundle weight. These new candidates will increase reliability, save cockpit space, reduce pilot workloads and increase the efficiency of the overall Cobra weapon system.

These three articles have provided a look at the programs and type of equipment to be utilized to completely modernize the AH-1S Cobra TOW to meet the needs of the Army through the 1980s and 1990s.



MODERNIZED COBRA

The Aircrew Training Program

(Formerly Known as the Flying Hour Program)

Captain David R. Esterak
Headquarters III Corps and Fort Hood
Fort Hood, TX

LET US ASSUME that the time has come once again for all aviation unit commanders to formulate the flying hour request for the next year.

"*Schazbot.*" You say, "What's the use, I never get what I ask for, and I'll just have to figure out how to do the job with less."

Well, don't fret fellow aviator. This year you can develop a program that cannot be so easily disputed by those who control the money. Notice the worksheet on these pages. If you can read, multiply, add and subtract, your problems are over.

The "Commanders Guide" (TC 1-134) tells us to use authorized strength when computing the request, which is okay. However, while you're at it, check with personnel and find out what your expected aviator strength is for next year. Now use the worksheet to work up a program for both authorized strength and expected strength.

The majority of the form is self-explanatory; however, some clarifications must be made. The numbers and letters within the brackets of the equations are paragraph numbers, not Einstein's early equations.

When determining the number of aviators to be qualified or refreshed, the unit's past experience

UH-1
Aircrew Training Program Development

1. **General Data**
   - a. Unit _____
   - b. Number of authorized aviators to fly UH-1s as their primary aircraft:
     (1) FAC 1_____ (2) FAC 2_____ (3) Total_____
   - c. Number of assigned aviators to fly UH-1s as alternate aircraft:_____
   - d. Number of assigned aviators to fly UH-1s as additional aircraft:_____
   - e. Annual turnover rate of authorized aviators:_____
   - f. Estimated number of newly assigned aviators: [1b(3)] × [1e] _____
     (1) To be qualified_____ (3) To be FAC 1_____
     (2) To be refreshed_____ (4) To be FAC 2_____
2. **ATP development factors**
   - a. Qualification training planning factor.....70.5 hrs
   - b. Refresher training planning factor.....37 hrs
   - c. Mission training planning factor.....18 hrs
   - d. Continuation training planning factor for:
     (1) FAC 1.....48 hrs
     (2) FAC 2.....30 hrs
   - e. SFTS planning factor (20 hrs required).....20 hrs
   - f. Maintenance factor (as determined by unit).....___%
   - g. Alternate aircraft factor.....24 hrs
   - h. Additional aircraft factor.....12 hrs
   - i. Individual aviator training planning factor (Average number of hours per aviator devoted exclusively to individual aviator training).....___
3. **Flying hours required**
   - a. Newly assigned aviators:
     (1) Qualification: [1f(1)] × [2a].....___
     (2) Refresher training: [1f(2)] × [2b].....___
     (3) Mission training: [1f] × [2c].....___
     (4) Continuation training for:
     FAC 1: [1f(3)] × [2d(1)] × .75.....___
     FAC 2: [1f(4)] × [2d(2)] × .75.....___
     (5) Total of (1) thru (4) above.....=___
   - b. Continuation training for remainder of unit:
     (1) FAC 1: [1b(1)] - [1f(3)] × [2d(1)].....___
     (2) FAC 2: [1b(2)] - [1f(4)] × [2d(2)].....+___
     Total.....=___
   - c. SFTS utilization [1b(3) × 2e].....___
   - d. Mission support hours required (list specific support missions and hours on reverse).....___
   - e. Individual aviator training [1b(3)] + [1c] × [1d] × [2i].....___
   - f. Alternate aircraft requirements [1c × 2g].....___

should be reviewed. In many instances, newly assigned aviators will not require qualification or refresher training.

The factors in paragraph 2 may be changed to suit your needs. Consult the appropriate aircrew training manual (ATM) and you will find the qualification training factors in chapter 2, the refresher training factors in chapter 3 and so on. Each ATM allows a certain amount of flexibility in these factors. However, I recommend that you use the maximum when computing refresher training and mission training. This worksheet is designed to give you a program capable of doing the job with no leftovers.

If you have a Synthetic Flight Training Simulator (SFTS) available you should use it as much as feasible. For UH-1 Huey aviators the full 20 hours should be used. As for the CH-47 Chinook aviators, you may want them to do some of their instrument training in the aircraft. To adjust the SFTS factor, simply subtract from 20 the number of first pilot instrument training hours you want your aviators to perform in the aircraft, and your answer will be the SFTS factor.

Individual aviator training is computed by determining how many flying hours are required to perform those tasks that cannot be performed in conjunction with mission support. Tasks such as autorotations, emergency procedures, check rides, etc. comprise this training. Consult the tasks and iterations required in chapter 5 of the appropriate ATM for guidance. Determine the number of hours your average aviator requires for individual training and that is your individual aviator training factor.

Mission support hours required (paragraph 3d) will, in most cases, be the hardest question to answer. Detailed input from supported units should be solicited to help in this area.

g. Additional aircraft requirements [1d × 2h] ....___

4. Recapitulation
   a. Newly assigned aviator requirements [3a(5)] ....___
   b. Continuation training for the remainder of aviators [3b(3)] ....+___
   c. Alternate aircraft requirements [3f] ....+___
   d. Additional aircraft requirements [3g] ....+___
   e. Total [4a] + [4b] + [4c] + [4d] ....=___
   f. Less SFTS utilization [3c] ....−___
   g. Total ATP training hours required [4e] - [4f] ....=___
   h. Less individual aviator training [3e] ....−___
   i. Available training hours to be performed in conjunction with mission support ....=___
   j. Mission support hours required [3d] ....−___
   k. Difference ....=___

5. Aircrew training program summary
   a. Total ATP training hours required [4g] ....___
   b. Mission support hours [4k only if negative] ....+___
   c. Maintenance hours: [5a] + [5b] × [2f] ....+___
   d. Total first pilot hours required [5a] + [5b] + [5c] ....=___

OH-58 (Scout)
Aircrew Training Program Development

2. ATP development factors
   a. Qualification training planning factor .... 10 hrs
   b. Refresher training planning factor .... 37 hrs
   c. Mission training planning factor .... 18 hrs
   d. Continuation training planning factor for:
      (1) FAC 1 .... 142 hrs
      (2) FAC 2 .... 60 hrs
   e. SFTS planning factor (20 hours required) .... 20 hrs
   f. Maintenance factor (as determined by unit) ....___%
   g. Secondary aircraft factor .... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ....___

AH-1
Aircrew Training Program Development

2. ATP development factors
   a. Qualification training planning factor .... 30 hrs
   b. Refresher training planning factor .... 37 hrs
   c. Mission training planning factor .... 18 hrs
   d. Continuation training planning factor for:
      (1) FAC 1 .... 66 hrs
      (2) FAC 2 .... 24 hrs
   e. SFTS planning factor (20 hrs required) .... 20 hrs
   f. Maintenance factor (as determined by unit) ....___%
   g. Secondary aircraft factor .... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ....___

OH-58 (Observation)
Aircrew Training Program Development

2. ATP development factors
   a. Qualification training planning factor .... 10 hrs
   b. Refresher training planning factor .... 37 hrs
   c. Mission training planning factor .... 18 hrs
   d. Continuation training planning factor for:
      (1) FAC 1 .... 120 hrs
      (2) FAC 2 .... 60 hrs
   e. SFTS planning factor (20 hrs required) .... 20 hrs
   f. Maintenance factor (as determined by unit) ....___%
   g. Secondary aircraft factor .... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ....___

Notice that only first pilot hours are used in computing the aircrew training program (ATP). Obviously, there can be only one first pilot at any one time; therefore, first pilot hours will be equal to aircraft hours. Don't make exceptions for an instructor pilot. These few hours provide a small amount of flexibility in the program.

Space permits only one ATP development worksheet in its entirety (the Huey given here). However, you can make a worksheet for each type aircraft by changing the factors in paragraph 2 as shown for the various aircraft following the UH-1 worksheet. Except for the paragraph 2 factors, worksheets will be identical to that shown for the UH-1. You should therefore follow the outline items 1, 3, 4 and 5 given for the UH-1 and use the appropriate paragraph 2 related to your aircraft.

If your training hour requirements exceed your mission support hour requirements, you can determine your minimum ATP requirements at any level of aviator fill, by simply multiplying the bottom line (paragraph 5d) by the percent of aviator fill. If your mission requirements exceed your training requirements, you must complete an additional form for each level of aviator fill less than 100 percent.

There it is, short and simple. After you have completed the worksheet once or twice, you should begin to see that it will provide you the hours needed to accomplish your mission, without wasting hours and money. As we all know, both are in short supply today.

Like all good forms there is always room for improvement. Your comments are solicited and should be forwarded to: Commander, III Corps and Fort Hood, ATTN: AFZF-DPT-TA (CPT Esterak), Ft. Hood, TX 76544. Or you may call AUTOVON 737-7103/7411, or commercial, area code 817-685-7103/7411.

CH-47
Aircrew Training Program Development

2. ATP development factors
   a. Qualification training planning factor ..... 30 hrs
   b. Refresher training planning factor ..... 37 hrs
   c. Mission training planning factor ..... 7 hrs
   d. Continuation training planning factor for:
      (1) FAC 1 ..... 41 hrs
      (2) FAC 2 ..... 24 hrs
   e. SFTS planning factor (20 hrs required) ..... 20 hrs
   f. Maintenance factor (as determined by unit) ..... ___%
   g. Secondary aircraft factor ..... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ..... ___

OV-1
Aircrew Training Program Development

2. ATP development factors
   a. Qualification training planning factor ..... 75 hrs
   b. Refresher training planning factor ..... 37 hrs
   c. Mission training planning factor:
      (1) FAC 1 ..... 68 hrs
      (2) FAC 2 ..... 21 hrs
   d. Continuation training planning factor for:
      (1) FAC 1 ..... 178 hrs
      (2) FAC 2 ..... 88 hrs
   e. SFTS planning factor ..... ___
   f. Maintenance factor (as determined by unit) ..... ___%
   g. Secondary aircraft factor ..... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ..... ___

U-21/C-12
Aircrew Training Program Development

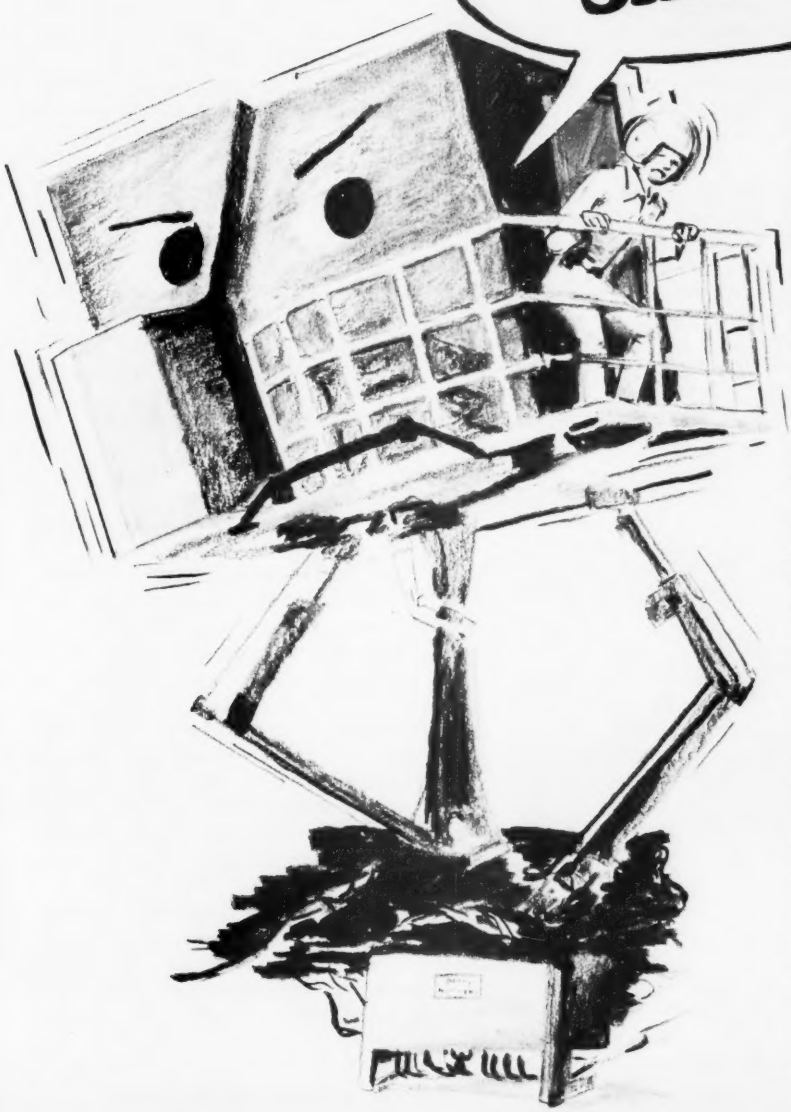
2. ATP development factors
   a. Qualification training planning factor ..... 25 hrs
   b. Refresher training planning factor ..... 37 hrs
   c. Mission training planning factor ..... ___
   d. Continuation training planning factor for:
      (1) FAC 1 ..... 25 hrs
      (2) FAC 2 ..... 24 hrs
   e. SFTS planning factor ..... ___
   f. Maintenance factor (as determined by unit) ..... ___%
   g. Secondary aircraft factor ..... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ..... ___

T-42
Aircrew Training Program Development

2. ATP development factors
   a. Qualification training planning factor ..... 15 hrs
   b. Refresher training planning factor ..... 37 hrs
   c. Mission training planning factor ..... ___
   d. Continuation training planning factor for:
      (1) FAC 1 ..... 25 hrs
      (2) FAC 2 ..... 24 hrs
   e. SFTS planning factor ..... ___
   f. Maintenance factor (as determined by unit) ..... ___%
   g. Secondary aircraft factor ..... 24 hrs
   h. Individual aviator training planning factor (average number of hours per aviator devoted exclusively to individual aviator training) ..... ___

MONTHLY WRITING AWARD

Hi, I'm A Distraught Flight Simulator



Major Michael F. McGaugh
14th Field Artillery, USAR
Sioux City, IA

IH, M'I A thgilf simulator. Wait, let me try that again: Hi, I'm a distraught flight simulator. That's better. Please don't be alarmed. I sometimes get my wires crossed and have difficulty talking, but I'm OK now. To be more specific, I am the new CH-47 flight simulator your boss purchased and installed at the U.S. Army Aviation Center at Ft. Rucker, AL. If you like, you can call me CH47FS for short.

For the next few minutes, I want to take leave of my normal duties of training you aviators to talk about my evolution, *where* I am *strong* and *weak* and *why* I am *distraught*. I have been sitting on my thoughts until now, but have decided we need to talk to one another.

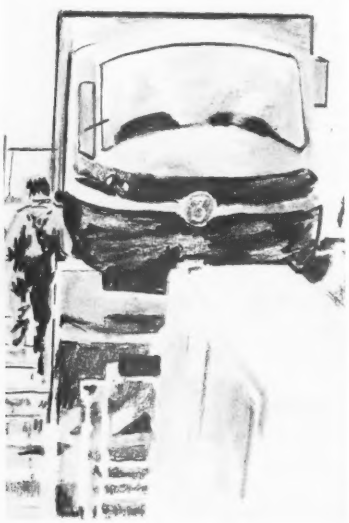
My evolution is the first matter at hand. Most of you came into this world after a gleam in the eyes of two people followed by 9 months of waiting. Well, I started as a gleam in a lot of peoples' eyes but it took me 10 years to develop. That is the reason I'm so smart. If you can remember back to the midsixties, you will recall that Army aviation experienced a period of rapid expansion. This growth of your profession cost your boss a lot of money and required the use of a great number of operational helicopters to train aviators.

Hi, I'm A Distraught Flight Simulator

In addition, these aircraft were combat assets that were needed in another part of the world. Consequently, the group of people with the gleam had enough foresight to see the need for a more economical training vehicle in the future. I think they also were very smart. Anyway, they wrote a document called a Qualitative Materiel Requirement. This book contained what the boss thought would be guidelines for a whole family of flight simulators.

I am the second generation of this family of flight simulators. My older brother is the UH-1 flight simulator and my younger brothers include the AH-1, UH-60 and AAH flight simulators. I was put on the drawing boards sometime in the early seventies, and by late 1976, I was developed enough to undergo factory testing. I ticked fairly well then even though there were a few problems.

My older brother is the UH-1 flight simulator



On completion of testing, I underwent a major operation in that I was disassembled and moved to my new home at Ft. Rucker. There I was reassembled and accepted by your boss after still another test of my systems. These tests up until now simply wanted to compare my capabilities against those requirements your boss wrote in the book. The proof of the pudding was still to come—another test designed to let me strut and prove my ability to train.

During the period from mid-January through mid-August 1977, I was the handreceipted child of an organization whose job it is to test aviation equipment. Their sole objective was to put me through the wringer and record my strengths, weaknesses and any degree in-between. That was the hardest 8 months of my existence, and some people say their evaluation was the most comprehensive ever conducted of a flight simulator.

They inspected me inside and out to make sure I was safe to operate; they checked to see if I looked, sounded and moved like the real thing; they verified that the operator console had sufficient knobs, dials, switches and buttons to make me work; and they trained a lot of aviators to determine those maneuvers that should and should not be taught with my aid. Then, they published a report telling the world how I fared on this flight physical; but since you may not have gotten the word, I will give you a brief overview.

Safety first. I was given a fairly clean bill of health on the safety inspections. The hazards noted during my physical constituted minimum and marginal hazards to people in general. Very few affect aviators. I must, however, confess that I did not have in my cockpit a self-contained internal fire alarm system. You need this protection because the operator is the instructor pilot, who will be sitting right behind you in the cockpit. Nobody will be monitoring us outside the flight compartment as we do our thing. A self-contained fire alarm system has been added.

I also feel obligated to warn you of my sound system. It *is* loud! If you elect to use this noise, please wear hearing protection because I am capable of hitting you with 100 decibels plus, and that exceeds your boss' regulations. And lastly, you must wear my seatbelt and shoulder harness assemblies when flying me. Since people tend to make mistakes, I have been programed to help you remember them when we crash.

That testing organization also assessed the validity of my design and physical concepts. In plain English, they checked to see if my looks, sounds and moves were like those of the actual aircraft. The test report says they were. As far as my looks go, I am the real thing. My cockpit was molded using fiberglass so that I closely resembled an actual Chinook. The way I was designed left some of my systems nonfunctional because I don't really need position lights in a building, even when you fly me at night.

Then I mentioned a few minutes ago that my sound system was loud. Well, it also is extremely realistic. That holds true during the execution of contact maneuvers and during emergency situations.

As far as my moves go, I am still having difficulty with the hustle. But don't worry, my other movements are like those of the aircraft. During this last evaluation, qualified aviators assessed my handling characteristics by rating the range of control movement and response; control centering operational and disabled; stabilization augmentation system (SAS) on and off, during contact maneuvers and emergency situations, and with internal and external loads. An area worthy of note was flight with SAS off. Some said I wasn't realistic. At

the same time, however, they said that anyone who could master me with SAS off could definitely fly the real thing.

My operator's console also was closely scrutinized. The opinion of most instructor pilots was that my controls and capabilities were more than adequate to bring the wraths of Hades on anyone sitting in the pilot's seat. Why, the instructor pilots have a magic wand at their disposal. They have console controls which allows flying visually in daylight, dusk or night conditions. They can make you land in confined areas, on a pinnacle and your choice of two lanes at a stagefield. They can let you execute standard instrument approaches all over the place or give you the chance to try a tactical instrument approach.

The winds can be made to blow so hard you don't go anywhere. There are controls to vary cloud ceiling, cloud tops, turbulence and visibility conditions. They can let me show off 200 plus malfunctions ranging from the simple popping of a circuit breaker to a combination of malfunctions that are nearly nonsurvivable. Yes, that means you may not survive the situation if you are in the actual aircraft.

Now, let's back up a bit. I have been telling you all about my fantastic capabilities and just remembered that you may not understand that I am a visual simulator as well as an IFR simulator. The first one in the Army. Even though I have all of these capabilities, I'm not perfect yet. During the 8-month test, I had problems with the color in my forward visual displays, the stability of the chin window displays, and picture focus. These problems supposedly are related to a temperature problem experienced in the building where I live. They should get better with time.

I also have a problem with the night visual scene. The people that flew me said they could not see the street lights and runway and taxi lights at the stagefield. The boss is supposed to be causing the redesign of this system to correct the problem. Just remember, I am a new breed of flight simulator and was a little ahead of my time.

What do you think so far? I think I am impressive. Now let's get into the meat of the subject—training students to fly the aircraft by training in a simulator. During this most recent test, I was used to train aviators from the Aviation Center and combat ready units. I think the testing organization called them institutional and combat ready flying (CRF) test subjects. Anyway, these aviators logged in excess of 1,200 hours in my cockpit and really gave me a workout. The institutional people trained in the simulator as if it was the actual aircraft using the aircraft program of instruction. The CRF pilots used me to supplement their normal unit flying program. Let's talk about the institutional aviators first then come back to the CRF aviators.

The institutional aviators went through the aircraft-developed program of instruction in the simulator without any training in the Chinook. The only maneuvers deleted were slope landings and water operations because they were beyond my capability. After the program of instruction had been administered in the simulator for the Basic Training phase, the test subjects were given Basic Training checkrides in the real thing. Then they continued with the program of instruction in the advanced phase in the simulator, then were given the final aircraft qualification checkride in the real aircraft. Once the big checkride was out of the way, the testers trained in the aircraft on those maneuvers which were unsatisfactory and those I was not capable of doing.

As you can probably see, the testing organization was collecting information on the amount of training time spent in me and the actual

Hi, I'm A Distraught Flight Simulator

aircraft along with the number of times each maneuver was performed. When the instructor pilots said the aviators were satisfactory on all maneuvers, they were terminated as test subjects. The training times and number of trials for the training period were used to compute what are called cumulative transfer effectiveness ratios and learning curves. The ratios are a measure of the savings realized in learning to operate an aircraft by first training in a training device—me.

The test report lists the ratios for each maneuver and also for the total training program. The learning curves provide a graphical presentation of changes in skill that occur with practice overtime. They are also in the test report. Enough of the hows, let's get into the whats.

For the entire institutional test, a ratio of .72 was calculated. As a basis for comparison, a ratio of 1.0 indicates the training device is as efficient as the actual aircraft. A ratio greater than 1.0 indicates the training device is more efficient and less than 1.0 is less efficient. The test ratio of .72 can therefore be interpreted to mean that the productivity of one training hour in me is equivalent to about three-quarters of an hour in the aircraft. Based on this there is a potential for saving a lot of money.

As you have probably guessed, the individual maneuvers transferred with varying degrees of performance. The ratios and learning curves indicate that maneuvers such as cockpit runup and shutdown; four-wheel taxi; two-wheel taxi; general airwork; acceleration and deceleration; SAS off flight; maximum performance takeoff; and instrument approaches might be taught in me without a degradation of performance when transferred to the aircraft. Maneuvers that showed varying degrees of performance degradation were: normal takeoff and approach; steep approach; external load operations; confined area approach and landing; and pinnacle approach and landing. These ratios hint that a blend of simulator and aircraft training is needed to get people up to speed.

Then there are those maneuvers accomplished close to the ground. They include: takeoff to a hover; hovering flight; landing to a hover; and shallow approach. These all were difficult to perform in me. Many variables could produce these effects such as limited field of view of my visual system or maybe the aviators have difficulty in judging height of hover, speed of movement and rate of closure. An approach to teach these maneuvers could be to demonstrate these maneuvers in me and then allow the aviator to practice them concentrating on the principles and fundamentals of the task. But the maneuver with a low transfer ratio should be taught in the actual aircraft. Thereby, we maximize the capabilities of both the simulator and the aircraft. Because of my difficulty in this area, my five counterparts which will go to field units will have a side window visual system in addition to the front window such as I have.

That also holds true for any aerial reconnaissance because you need to look out the side window and I don't have one. Even with these maneuvers classified as more difficult to learn in the simulator than in the aircraft, in one instance a couple of highly proficient single-rotor, single-engine aviators were able to pass the checkride for air-

craft qualification immediately after completion of the simulator training. That was some performance by those two.

Let's not forget the test aviators from the combat units. As mentioned, they used me to supplement their mission essential flying program. There also was a similar group of aviators designated as control subjects. Both groups were administered the same comprehensive checkride prior to the start of the test and again at the conclusion. The checkride was made up of most of the maneuvers in the institutional program of instruction. The pilots also did the maneuvers a second time with the protective mask. You heard me correctly. They did touchdown autorotations in a Chinook while wearing a gas mask. That will put hair on your toenails.

The only measure of performance in the CRF test was an analysis of the checkride scores by group. The aviators who flew the simulator to supplement their unit flying had checkride scores significantly higher than the control group. Some people say, however, that the additional training received by the test group would cause the increase in scores regardless of the type of training device used. That discussion is ongoing.

It hurts me to admit that the combat unit aviators who trained in the simulator experienced what is called a negative transfer of habit while doing autorotations on their final checkrides. That means they developed a technique for autorotations in the simulator that was hazardous in the Chinook. They found that if you learn to do an autorotation in me, and subsequently use the same technique in the CH-47, you have the tendency to be too fast while trying to touch down 50 feet above the ground. At least we found this out early and are now aware of the problem.

Well, that wraps up my last test. Now let's talk about the present

. . . some aviators say bad things about me . . . here's the real story!

and the reason I'm a distraught simulator. To put it bluntly, I am worried because some people say bad things about me and very few of them know the real story. I think I'm pretty good and have demonstrated it to your boss. I can save a lot of money, let you accomplish more work in every training hour, let you do things that you had better not do in the aircraft, and potentially save lives because I live on the ground and not in the increasingly crowded skies.

Many say bad things about me. If you ran an analysis of what they say, this analysis would reveal that people are divided into two groups. One consists of the aviators with a *lot* of flying time and the other group includes the newer experienced aviators.

The aviators with all of the flying hours don't like me because I believe they are misinformed. They grew up in your profession at a time before we true simulators were on the scene. They matured when the accumulation of flight time was no real problem and the trainer was thought of as a form of punishment. As a result, they cringe when they hear the word simulator because it brings back visions of bad memories in the fixed base procedural trainer and the blue canoe. If you want to know more about the procedural trainers and the blue canoes you can read about them in the January 1961 ("The Missing Link") issue of the *Aviation Digest*. The only way to get rid of those bad memories is to give me the chance to talk about myself.

The other group of aviators is confronted with an entirely different reason for disliking me. They are maturing during a period of time when simulation is of age and the accumulation of flight time is difficult. The problem with this group lies in my last statement. They have to fly simulators to maintain proficiency because the flight time is not available. Along with this, you must accept the fact that flight time in your records is the primary tangible measure of aviation experience, and these aviators want all the time they can get.

The desire for flight time is easily seen as soon as the newly graduated aviators proudly pin their wings on their uniforms. They immediately set the goal of 1,500 hours so they can become Senior Army Aviators, a physical display of their aviation experience. Once this goal has been attained, the amount of flight time becomes inconsequential.

If you don't believe what I'm telling you, take a minute and reflect through your experiences. How many times have you felt uncomfortable wearing the basic aviator wings while in the presence of a group of Senior Army Aviators? At the same time, and if you are a Senior Army Aviator, did you not lose some of the drive to strap-in once you had the magic number? This is the problem. There is no real incentive because simulator flight time opposes the fulfillment of their real goal. There is not a simulated carrot in the faces of the younger Army aviators. The solution is to dangle the carrot. What I suggest is to dangle my time for credit against the requirements for Senior Army Aviator. A one-for-one credit would be nice but is not necessary. *Credit of any sort will do the job!*

Editor's Note: The CH47FS at Ft. Rucker is a prototype. Production models for the field correct many of the problem areas and add a side window visual.

It can happen to you...

Captain George Kerrigan
Directorate for Investigation, Analysis and Research
U.S. Army Safety Center

U.S. ARMY SAFETY CENTER

MAYBE YOU ARE an extremely lucky pilot who has logged thousands of flying hours with never a problem. If so, congratulations. But the fact remains that even if this is the case, you are not immune to in-flight emergencies.

Last year (FY 1978) Army aviators had more than 2,650 of them. Most terminated in precautionary landings. Unfortunately, some did not. Curiously, one ingredient in the formula that invites problems is the pilot himself. Like it or not, we often find ourselves in unenviable situations that are of our own creation. And three of the many cause factors that can put us there are overconfidence, pride, and impatience. In my case, all three were present.

It all began one day in 1968 in RVN with an assignment to transport an individual on emergency leave. My job was to fly the individual to Ben Hoa from Phuoc Vinh, a distance of only 22 nautical miles over basically level ground covered with 150-foot-high trees. The flight to Ben Hoa was uneventful.

However, following our arrival, three people requested transportation back to Phuoc Vinh. The weather at this time was 1,000 feet overcast with heavy rain-showers and was deteriorating rapidly. The horizon was visible only where ground lighting existed. In retrospect, I should have cancelled the flight at that time, but I didn't. I was confident in my ability to handle any situation and confident I could handle the OH-6 (which was new to me as I had been flying OH-23s). Further, I wanted to accomplish the mission if for no other reason than to avoid any harrassment from my peers that might result from an unplanned RON. Finally, even though adequate quarters were available at Ben Hoa, I wanted to get home. There, in a nutshell, were my three sins: overconfidence, pride and impatience.

At takeoff, the weather was so bad I instructed the passenger in the copilot's seat on how to monitor the altimeter, and told him to warn me any time it indicated below 400 feet—a precaution I was later glad I had taken.

After departing Ben Hoa, I climbed to about 500 feet agl. Relying on peripheral vision and the ground lights of Ben Hoa, I flew about 5 miles northeast, searching for the lights of Phuoc Vinh. I had to circumnavigate several heavy

rainshowers and was flying in light rain when I spotted what I thought were three lights in the Phuoc Vinh area. I then transitioned my visual reference from the little remaining ground lighting associated with Ben Hoa to the three lights in the Phuoc Vinh area and used them for a visual horizon. The situation in which I had placed myself, the passengers, and the aircraft became obvious to me when one of the lights went out like a match, and I suddenly realized they were flares and not lights from the base.

Yet, instead of taking immediate corrective action, I continued to look at the two remaining lights until one of them went out. At that time, I realized I no longer had a visual horizon. But rather than transition to instruments as I should have, I snapped my head to the right and began a right descending turn to reestablish visual contact with lighting in the Ben Hoa area. The combination of these two actions immediately brought on a severe case of vertigo.

Although I could see the airspeed indicator was bouncing from 0 to 10 knots, my own senses told me I was descending vertically at an extremely high rate of speed. Mentally, I was incapable of believing my instruments and, physically, I could not force myself to push the cyclic forward to regain airspeed. As far as I was concerned, a crash was inevitable. My only thought was to hit the ground with the aircraft right side up.

While I could not force myself to push the cyclic forward, I managed to lower the collective to a near full-down position. Later, I found out that what appeared to me to be happening in a rapid and uncoordinated manner was actually occurring quite slowly and causing little or no concern to my passengers.

When I lowered the collective, I did not apply a corresponding amount of right pedal. This placed the aircraft in a basically level, rapid descent, while rotating slowly counterclockwise about the mast. As I descended through 400 feet msl, to about 100 feet above the trees, the passenger in the copilot's seat shocked me into reality by shouting that we were below the 400-foot level. His unanticipated warning caused me to immediately pull in collective pitch, stopping the rotation of the aircraft. Suddenly, I found myself looking at the lights of Ben Hoa beneath the overcast sky. I now had a real horizon with which to orient myself, and my vertigo disappeared as fast as it had appeared. Immediately, I moved the cyclic forward into coordinated flight and, needless to say, I returned to Ben Hoa.

This emergency should never have arisen, but once it did, an accident should have been the result. And had one occurred, the only accurate diagnosis would have been pilot error—an error in my judgment. I had allowed my feelings to dictate my actions instead of arriving at a sensible conclusion based on known facts.

However, my experience simply illustrates only one example of a pilot's willful actions resulting in an emergency situation. In my case, weather was a factor. Curiously, of the more than 2,650 in-flight emergencies that plagued Army pilots in FY 1978, weather was listed as a predominant factor in 111 of them. I can't help but wonder how many of the affected pilots contributed to these emergencies.

But weather does not have to be a factor for a pilot-induced emergency to arise. It could be an improper preflight or inadequate cockpit check. It could be willful violation of SOPs or regulations, such as performing unauthorized low-level flight and striking wires. The point is simple. When aviators allow their feelings or personal desires to overpower their judgment and govern their decisions, they may very well find themselves in hot water. I did. And believe it or not, it can happen to you.

U.S. ARMY SAFETY CENTER

Copilot error

YOU HAVE TO WONDER, reading about all those aviation disasters, how many labeled "pilot error" could as well have been labeled copilot error. And, if that is true, then how many aircraft tragedies could have been avoided had the copilot openly expressed his doubts and given his advice to the man making the final decision? We all know that this openness, this teamwork, is not always the case. Sometimes the copilot just doesn't speak up. Why not?

• Today you're copilot. Your pilot in command (PIC) is the overbearing type—loud, gruff, and, of course, infallible. He doesn't particularly care for advice from underlings, even if his copilot is also a qualified PIC, as you are. In turn, you don't especially feel like giving a crass fellow like this the benefit of your wisdom. It's more fun watching this "gift to aviation" occasionally get himself into jams—small ones—not major ones, you understand. Funny how he's always pontificating on the nuances of landing; yet, more often than not, he's the guy who prangs it in (ah, the exquisite amusement one's humiliatingly hard landing can engender in one's copilot!). Is this perhaps why you sometimes don't warn him that his rate of descent is becoming a bit much—not dangerous, mind you, just a bit much? (Variations of the scenario above have also been known to occur when the PIC is a "heavy," such as the unit commander or the operations officer, and the copilot is a "light," or feels like one.)

• It's a relief not having to sign for the aircraft, isn't it, copilot? You don't need the aggravation—or responsibility—of signing for this particular flight; a rather tricky sequence of stops here and there. Let the eager beaver make the decisions. At the weather briefing, thunderstorms are forecast throughout the legs of your journey. On preflight, radar advises that his radar is down. Considering the forecast, you have grave doubts as to whether you should go with this bird; but, then, you're not the PIC, so you don't voice them. He wants to go, and it's his decision.

• It suddenly dawns on all of you, prior to takeoff on your fourth and final leg of the day, that you're a little short of fuel. Like any good copilot you mention it to your PIC. He, however, is in a hurry and known refueling at this particular field will take longer than your average pit stop. He figures the destination weather is not all that bad and decides to get on with the flight. Your interpretation of destination weather is not quite so optimistic, however, which is why you'd like to put on another couple hundred pounds or so. But, rather than create a fuss with your PIC, who seems to have made his decision, you don't press the issue. As it turns out, you finally make it home, after having to hold for an unanticipated 30 minutes, with less than prescribed fuel minimums.

• A planned 15-minute passenger stop at a civilian airfield with no C-12 support turns into an hour-and-a-half delay when the No. 1 chip light comes on during taxi for takeoff. It's getting late. The PIC figures he'll go ahead and take off in the fast dwindling daylight with the chip light on and get the plane back home, rather than be stuck for the night at an airfield without adequate support. You, the copilot, also a qualified PIC, are aware you shouldn't take off with the chip light on, but, like everybody else, you'd like to get home. So, though you have some qualms as to the wisdom of this decision, it's not your aircraft in any case. You decide not to strongly object to this move.

Obviously, there's more to copiloting than just those mundane tasks we usually associate with the second pilot: helping with the filing and the preflighting; reading the checklists; and calling airspeeds, altitudes, and angles of bank. These may get aircrews through the average flight, but then there are those days, those crucial moments, those times when a pilot should not be left a lonely island in his decisions. These are the moments when the copilot must play the devil's advocate, or perhaps become an accessory to an imprudent, possibly tragic, decision. It is not for the copilot to indulge the darker side of his so human nature, the side that sometimes enjoys another man's woes, the side which occasionally does not want to interfere or get involved because . . . it's not his aircraft. Nor should he withhold his advice because he fears or dislikes his PIC. The copilot's constant concern must and should be the safe conduct of the flight. He must operate at all times on that lofty plateau.

With the emergence in recent years of the flight commander, now jointly responsible with the PIC for the conduct of the flight in its entirety, the copilot seems to have become the forgotten man. He has no logs to complete, almost no essential role to perform (except those indicated in the checklist). He is rarely required at debriefs. Little wonder that today's copilot may feel unmotivated and uninvolved.

Yet, it is this being slightly removed from the action that is precisely what can, and should, render the copilot so invaluable to the safe conduct of a flight. It is this separation that should enable the copilot to put things in their proper perspective, to see the forest while everyone else is, perhaps, zeroing in on the trees.

Adapted from APPROACH

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, DARCOM, ATTN: DRCPO-ALSE, POB 209, St. Louis, MO 63166

Record Form

Many aviation units have established "take it out of your hide" aviation life support equipment (ALSE) shops to maintain and inspect ALSE on a scheduled basis. Many of the Army ALSE shops are patterned after the Air Force and Navy ALSE shops.

All shops have paperwork which is necessary to maintain a record of what has been done and what needs to be done. We recommend that you visit an Air Force life support equipment shop, and borrow some of the record forms needed for your shop. Listed are the forms we recommend:

- AFTO Form 334—Helmet and Oxygen Mask Inspection Data
- AFTO Form 335—Pressure Suits and Anti-Exposure Suit Inspection Data
- AFTO Form 336—Life Preserver Inspection Data Record
- AFTO Form 337—Life Raft Inspection
- AFTO Form 338—Survival Kit Inspection Record

P.S. Thanks to Mr. Norman Rombach.

Despite False Alarms

The emergency locator transmitter (ELT) is still one of the most effective means of locating crashed aircraft, despite false alarms that are sometimes emitted, according to the Air Force Coordination Center at Scott Air Force Base, IL.

The Center said that 4,480 ELT signals were reported last year, but only 146 crash sites were located and 84 survivors were rescued with the aid of the ELT signal. Of the total signals, about 2,700 were "bogus" and were terminated before being located. Another 1,600 signals were detected mostly from aircraft parked at airports, and silenced.

A valid argument presented is that we have adequate signal devices such as the flare, signal mirror and the survival radio. But, how effective are these items if you have broken bones or are unconscious and unable to use them? So on goes the discourse regarding the need for the ELT. What's your opinion?

Let us know!

Not For Flight

We receive a number of inquiries on how Nomex flight clothing should be worn or if it can be tailored. Some research produced AR 670-1 and AR 710-84 regarding the wear of clothing and uniforms. However, they did not specifically answer our question on the wear or tailoring of the flight uniform.

A common sense approach is recommended due to the research performed by the folks at the U.S. Army Aeromedical Research Laboratory (USAARL) at Ft. Rucker, AL. Form fitted clothing looks very military and sharp, but blotch tests performed at USAARL determined that loose fitted clothing with the air space offered greater protection in an aircraft fire, especially if the clothing happened to be saturated with fuel. It also is recommended that the pant legs not be bloused, that your sleeves be down and fastened and the collar turned up and buttoned/fastened at the neck. To simplify, our recommendation is that "skin tight—is not for flight."

Don't Dye It

Some aircrewmembers feel that the color of the new CWU-27/P one piece Nomex flight suit should be dyed to the olive green color like your flight jacket. Many dyes on the market today contain flammable substances which will reduce the flame retardancy of your flight uniform, thus aborting its purpose. Until we find some dye which we can recommend—don't dye it.

Flight Foot-Wear

What is the most appropriate article of foot-wear to be worn by the aircrewmember? Unfortunately there is no one best answer for everyone. Navy aircrewmembers have been wearing steel toe/shank safety boots for several years now. A safety boot also is available to Army aircrewmembers under NSN series 8430-00-135-2672, and is listed in SB 700-20 under line item number CO8871.

For Some Reason

We recently discovered that for some reason an Army aircrewmember from Germany, attending one

Bennie Duhaime

Photo by Tom Greene

of the aviation courses at Ft. Rucker, was still wearing the old **"obsolete"** APH-5 flight helmet. There is only one flight helmet authorized for Army aircrewmembers, and that is the SPH-4 flight helmet. (There are a few specific exceptions to this rule.)

Every aircrewmember should be outfitted with a complete set of the latest authorized flight clothing. But who is responsible to ensure that all aircrewmembers are wearing the latest styles? The answer to this question can be found in AR 385-32, "Safety, Protective Clothing and Equipment." We recommend that every aviation unit commander and aircrewmember review this regulation.

A Warning Of Interest

CO_2 is an acceptable fire extinguishing agent, once a fire has developed. In no case should CO_2 be directed into a battery compartment of your aircraft to effect cooling or displace explosive gasses. The static electricity generated by the discharge of the extinguishers could explode hydrogen/oxygen gasses trapped in the battery compartment.

OPMS CORNER Officer Personnel Management System

Aviation Personnel Update

Major William B. Leonard III
Officer Personnel Management Directorate
U.S. Army Military Personnel Center

SINCE APRIL, OPMS Corner has been devoted primarily to various discussions of the aviation career pattern. Translating management policy into the training and assignment decisions that affect the career of every aviator will remain a dynamic process for years to come; so our intent is to keep everyone "up to speed" on where we stand, both in concept and in practice, and where we are headed.

The career pattern decision was not intended as an instant cure-all for the management turmoil through which aviators have progressed since Vietnam. But, it has given the Army a foundation upon which to build a total aviation program—one that will ensure, for both the near and long-term, mission accomplishment *and* individual career opportunity.

During the last few months we have gone through a period of intensive analysis to determine the type of "structure" to build on our foundation. It has not been an easy process due to the interrelationships of many factors, such as: the role of Specialty 15 in the Officer Personnel Management System; over- and under-strength officer year groups; the tactical and technical demands of aircraft systems and employment; the Aviation Career Incentive Act; training and flying hour costs; and the "total force" approach to aviation manpower.

The bottom-line question to be answered is: "What kind of structure will best enable us to fight our aviation forces and at the same time provide opportunity for full career progression?" An answer cannot be provided unilaterally by Headquarters, Department of the Army (HQDA). It will require a joint effort between HQDA staff elements, the major commands and their aviation proponents. Part of this effort has been underway for some time now with the development of a tactical organization and command structure proposal for aviation employment in the future by Training and Doctrine Command (TRADOC).

Joining this proposal to recent management decisions is the mission of an aviation task force recently assembled at HQDA with representatives from the key aviation "users." This effort promises to be one of unusual significance for Army aviation, as its main emphasis will be on the molding of aviator career development objectives from a tactical/management base.

In short, the Army has answered the question on what it wants Specialty 15 aviators to do and be: Combat arms officers who are experts in aviation doctrine, organization and equipment and its application to all mission requirements (combat, intelligence, research and development, air traffic control, etc.); aviation leaders and staff officers, not "airplane drivers"; able to progress within a viable *aviation* career pattern. The next step is the complete review by the task force of our aviation structure to ensure accurate position category (commissioned or warrant), grade, specialty coding, and operational/non-operational status, along with the tactical organization proposals from TRADOC. It promises to be an exciting fall and winter for Army aviation as we get on with a task that will be of importance to all of us. We will continue to keep you informed as progress is made.

JAAT

Staff Sergeant Bob Hubbert

Public Affairs Office
U.S. Army Combat Developments Experimentation Command
Fort Ord, CA

Photos by
James Arnold and Bob Hubbert

THE UNITED STATES Army and the United States Air Force are changing the way the next war will be fought. The change incorporates a new system of battlefield organization, and has been termed JAAT (joint aerial attack tactics).

Specifically, JAAT will ensure that battlefield maneuvers and attacks by friendly air assets (both Air Force and Army) will be consolidated and organized. Air assets control will be the responsibility of a JAAT team. The team consists of an Army pilot (flying an OH-58 scout helicopter) and an Air Force forward air controller (FAC).

The JAAT team will fly their scout helicopter with a mix (three more scouts and five AH-1 Cobra attack helicopters) up to the forward edge of the battle area. From their position "out front," they'll relay enemy positions to an Army

Air Force A-10 close air support jets combine with Army Cobra helicopters to test the new JAAT procedures during the TASVAL trials at Ft. Hunter Liggett

"battle captain" (airborne with the mix of attack helicopters) and to another Air Force FAC, airborne and to the rear of the battle area. It is at this point that a joint attack, combining Army and Air Force air assets, will begin.

Air Force jets, primarily the A-10 close air support (CAS) anti-armor attack plane, and Army Cobra attack helicopters have been waiting "on-station" for orders to attack. After siting single targets (tanks, vehicles or air defense artillery (ADA) sites) or mass concentrations of enemy forces, the JAAT team will "hand-off" specific targets or target areas to the attacking aircraft. This procedure is done simultaneously, thus enabling friendly forces to put fire on the enemy from many different directions, and at the same time. The resulting effect of this mass attack can be devastating.

ATWEST devices are used by the Cobras to simulate firing TOW missiles during the TASVAL trials. Once the Cobra pilots have fired at selected targets, the JAAT team (in OH-58 scout) will direct the Cobras to new firing positions

A JAAT team and a Cobra helicopter move cautiously across one of many lakes and ponds that dot the military reservation in California

The JAAT concept of warfare is being tested at Ft. Hunter Liggett, CA, during a joint services test of antiarmor capabilities. The test is called TASVAL, and employs Army helicopters, Air Force A-10 jets and tanks that pose as both friendly and enemy forces. Collectively, this assemblage of military assets is proving the JAAT concept under realistic battlefield conditions.

The test is being conducted under the direction of the Army's Combat Developments Experimentation Command, headquartered at Ft. Ord, CA.

Although the test will consume 9 months of preliminary and record trials (mock battles), JAAT training and testing has just begun. From all indications, the JAAT concept of air-to-ground attack tactics soon will become an integral part of military antiarmor doctrine.

Major Kenneth McGinty, commander of "C" Troop, 7-17th Cavalry, 6th Cavalry Brigade (Air Combat), Ft. Hood, TX, firmly believes that the JAAT concept of com-

bined air strength and control is the future of battlefield organization.

"JAAT is proving that combined air assets and coordinated attacks will have a synergistic effect on the enemy's ability to pose an offensive or defensive threat to friendly forces," said Major McGinty. "That is, by affecting coordination of two resources on the battlefield (Air Force/Army), and by concentrating more aircraft—Cobras and A-10s—in a battle area, JAAT degrades the enemy's effectiveness. With our insertion of many aircraft into the battle area, the enemy is unable to concentrate his fire on selected targets. He's literally under the gun."

An Air Force A-10 jet uses computerized laser fire to destroy targets at Ft. Hunter Liggett during the TASVAL trials

During TASVAL, the Army hopes to standardize JAAT procedures. Air space coordination, handing-off of targets, attack tactics and overall control of battle and attack procedures will be refined by the end of the testing period. When all procedures appear to be a "go," the 6th Cavalry Brigade at Ft. Hood, TX, will conduct a "live fire" JAAT exercise. Tentatively, this JAAT trial is planned in the fall.

A unique concept of JAAT is that of firepower. By combining Army and Air Force air assets, a JAAT team has five different killing systems at its disposal.

The A-10's main line weapon system is the Maverick missile. This "fire and forget" missile enables the pilot to actually look through the nose of Maverick via two television viewing screens (one in the cockpit of the plane and the other in the nose of the missile) and lock on to the target very quickly. Once locked-on, the A-10 pilot maneuvers out of the battle area by flying nap-of-the-earth and using trees, gullies and hills to hide from enemy detection and acquisition. The Maverick missile is deadly from distances as far away as 5 kilometers, and almost always destroys its target. Additionally, the A-10 is equipped with armor killing cannons.

The Cobra attack helicopter is equipped with the tube-launched optically-tracked, wire-guided (TOW) missile system. The TOW is optically controlled when fired,

Two Cobra attack helicopters from "C" Troop, 7-17th Cavalry, move into their firing positions in the "Gabilan" area of Ft. Hunter Liggett while the JAAT team (in the OH-58) scout above moves out to find other "enemy" positions

and wire-guided to its target. The maximum effective range of the TOW is 3,750 meters. Together with the Maverick, the JAAT team has the capability of calling for fire from ranges outside the effective threat capabilities of enemy ADA or armor units. This will enhance the position of the ground forces commander when entering the battle area, as by this time the enemy should be buttoned-up and on the run.

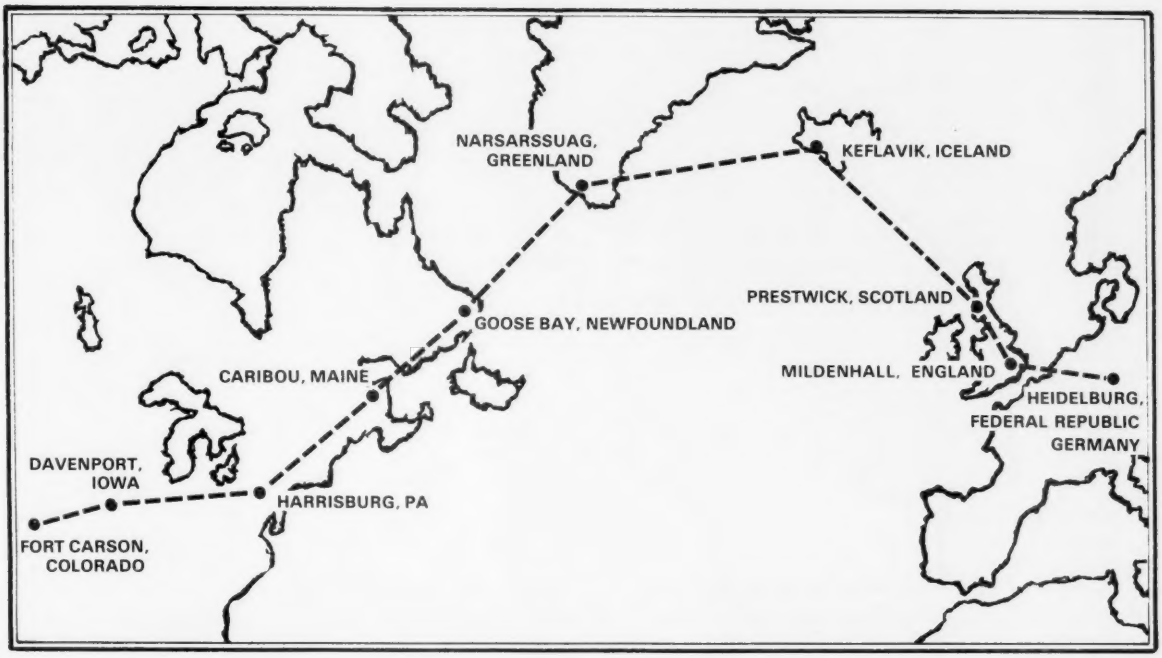
Once the initial attack by friendly forces has begun, the JAAT team will hand-off specific moving or stationary targets to A-10s and Cobras. These targets could be anything that pose a threat to the advance of friendly forces.

"During a JAAT," said Major McGinty, "we'll hunt down and kill any ADA or enemy defensive threat that precludes us from performing our joint mission (Army/Air Force air) of killing tanks. We don't quit looking for tanks, we just kill everything. JAAT is in line with our primary military function: to support ground commanders in their scheme of maneuver. By using our newly developed JAAT procedures, we should be above to provide them with a clear and relatively unopposed avenue of approach into the battle area."

The JAAT concept of coordinated and consolidated attacks appears to be working during the TASVAL trials. Collectively, the number of tank "kills" by combined air assets far exceeds those of restricted military engagements (Air Force and Army aircraft by attacking independently of each other).

At the conclusion of TASVAL, military and civilian leaders will review the results of the JAAT tests. Soon, they hope, they'll be able to develop a standing operating procedure for future JAAT operations that will, in effect, rewrite the way the next war will be fought, and won.

An A-10 CAS jet closes on an "enemy" position during trials (mock battles). The jets and helicopters are working together during the TASVAL test to provide data for military and civilian leaders



Operation Northern Leap

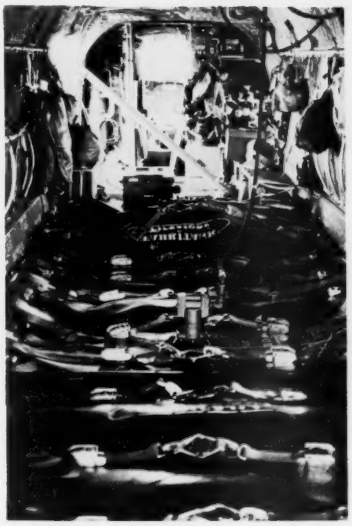
FOUR UNITED STATES Army CH-47C Chinook helicopters landed in Heidelberg, Germany, 20 August completing "Operation Northern Leap," a precedent-setting mission in which Chinooks flew the 5,200 nautical miles to Europe from the United States without aid of aerial refueling. The exercise began from Ft. Carson, CO 6 August and included nine stopovers for ground base refueling.

The mission demonstrated that Chinooks could be self-deployed from the continental United States to Europe if required by military necessity. Such a move would then free other transportation vehicles —either large ships or military aircraft—for moving top priority military support equipment.

The Chinooks were from the 179th Medium Lift Helicopter Company, Ft. Carson. They have been assigned to the European command.

The four CH-47C helicopters that participated in historic Operation Northern Leap

ABOVE: The next leg of the 6,000-mile flight from Ft. Carson, CO to Manheim, Germany, is reviewed by CPT Steven H. Gilbertson, third from left, the mission commander, during a refueling stop at New Cumberland Army Depot, PA. With the captain are, from left, SGT Harry Wolfe and SGT William H. Childers, crewchiefs, and CW3 Walter M. Fox, the flight safety officer. LEFT: CH-47C Chinooks arrive at New Cumberland Army Depot, PA, on the third leg of their historic journey



ABOVE: The Chinooks at a refueling stop during their record-setting journey. RIGHT: Internal fuel bladders (depleted in photo) allowed the Chinooks to remain airborne during Operation Northern Leap. The bladders hold 2,000 additional gallons of fuel and increased the maximum flight time from the usual 3 hours to more than 9 hours. BELOW: To demonstrate support readiness, during the operation one of the Chinooks performed a routine tactical mission by transporting a 6,000-pound Lance missile and carrier

GCA Controller/Pilot Proficiency

Why not try a GCA?

Don't save it for a rainy day!

WHEN NEWLY graduated radar controllers are assigned, they must receive additional training at their respective installations. This additional training leads to a facility rating. New ground controlled approach (GCA) controllers have 90 days to acquire the facility rating. A newly assigned GCA controller, who has held a GCA facility rating within the previous 18 months, has 60 days to obtain the new rating.

This phase of the controller's training involves familiarization with the operational procedures and techniques peculiar to that airfield. The brand new or newly assigned GCA controller *must* know the full picture concerning traffic patterns, letters of agreement, airspace problems, navigational aids, terrain features and the relationship of the airfield to other civil/military airports.

Now, assuming that the controllers have attained their ratings, they have it made. Wrong! To retain their proficiency, rated radar controllers are required to demonstrate satisfactory performance of duties in all control positions associated with the rating held for a total of 80 hours each calendar month. In addition, they must conduct 10 actual approaches of which seven must be precision approaches. Also, they must conduct at least five no-gyro and/or emergency approaches, actual or simulated, during each calendar month. For proficiency purposes, rated controllers may not count more than five trainee conducted approaches that they monitor.

Although 50 percent of GCA proficiency approach requirements may be simulator approaches, these are necessary substitutes because of the inadequate numbers of actual approaches. This brings us to an important point. How does the GCA facility get the necessary runs to keep the controllers proficient? You Army aviators are the best available source of practice "live" GCA approaches for these people—and vice versa. We all know that an experienced controller can put you right on the runway numbers, provided they have had the practice—*and, provided you have had the practice!*

To help your GCA operators maintain a sharp edge on their proficiency, and you on yours, why not give GCA a call on the way in from your next flight? If you can, request a few practice approaches. Frequent use of the facility keeps the controllers proficient, helps their morale, spotlights equipment deficiencies, and builds a strong foundation for a sound controller-pilot relationship. Commanders can help this happen by having their pilots habitually request a practice GCA when they contact the tower inbound.

Get to know the capabilities of your GCA facility and use it. Don't save it for a rainy day!

Readers are encouraged to address matters concerning air traffic control to:

Director
USAATCA Aeronautical Services Office
Cameron Station
Alexandria, VA 22314

Lieutenant Colonel Larry G. Kelly
U.S. Army Troop Support and Aviation Materiel Readiness Command
St. Louis, MO

Helicopters And Parachutes Not Always Compatible

JUST AS DRINKING and driving often lead to disasterous accidents—so can parachutes and helicopters when safety rules are ignored.

Too many reports from the field relate instances where aircraft are damaged or destroyed and personnel injured when parachutes on the ground are reinflated and sucked into the helicopter rotor systems. In a recent accident the helicopter pilot touched down before the landing zone (LZ) had been cleared during an air drop exercise. The accident that occurred could have been avoided had normal safety procedures been followed.

To prevent such accidents the ground unit commander, in coordination with the supporting aviation unit, must select helicopter LZs that best support the assigned mission. However, among the many considerations are the nature and conditions of the landing surface.

As a guide, a helicopter LZ requires a relatively level, cleared circular area at least 20 to 75 meters in diameter, depending on the type of aircraft being used. In addition, the area surrounding the LZ must be cleared of loose obstacles that could cause main and tail rotor blade strikes or damage to the underside of the aircraft.

When airborne operations precede airmobile or helicopter operations, the LZ must be cleared of parachutes and other equipment. In the event obstacles or hazards cannot be removed, pilots should be advised of the existing conditions before touchdown.

Safety Conference

Betty Goodson
Public Affairs Office
Fort Rucker, AL

ABOUT 75 SAFETY representatives from the nation's military forces and other government agencies met at Ft. Rucker, AL late last August for the 18th Joint Services Aviation Safety Conference.

A welcome from the Rucker community was given in the 3-day meeting's opening session by Major General James H. Merryman, Ft. Rucker's commanding general. He told the audience that the Army is scheduled to have a new division structure and many new pieces of equipment during the 1980s, and that safety will impact on all of the changes.

"There will be safety aspects in all of this which I'm not smart enough to even think about," General Merryman said, "but I know all of you are, and I will appreciate your giving your attention to them."

The keynote address was by Brigadier General Joseph C. Lutz, assistant director, Human Resources Development, Deputy Chief of Staff for Personnel, Department of the Army, Washington, D C.

"At this conference, we have the opportunity to find the common ground of common problems which we have in the safety business," General Lutz said.

He talked about the Army's experience in fiscal year 1978 as proof of the need for comprehensive safety programs. "We killed a battalion of people last year in accidents, and you have to think about that. So far in fiscal year 1979, we are doing a little better. We have had 9,934 accidents which have resulted in 238 fatalities and 6,239 disabling injuries."

Noting that he did not know the figures for the Navy, Air Force and Coast Guard, General Lutz said he could say that each service needs improved accident prevention programs. "Safety is a very important business for all of us because its ultimate goal is the preservation of our resources so we are ready to go to war at all times."

Titles of the five seminars which were held to discuss some 24 new agenda items were life sciences, system safety, education and training, aircraft mishap preventon and investigation, and analysis.

Conference host agency was the U.S. Army Safety Center located at Ft. Rucker and commanded by Colonel Edward E. Waldron II. Coordinator for the event was Allen F. Almquist Jr. Next year's meeting will be held at Norton Air Force Base, CA, location of that service's safety and inspecton center.

Next month the Aviation Digest will carry an expanded article from the Army Safety Center about this conference.